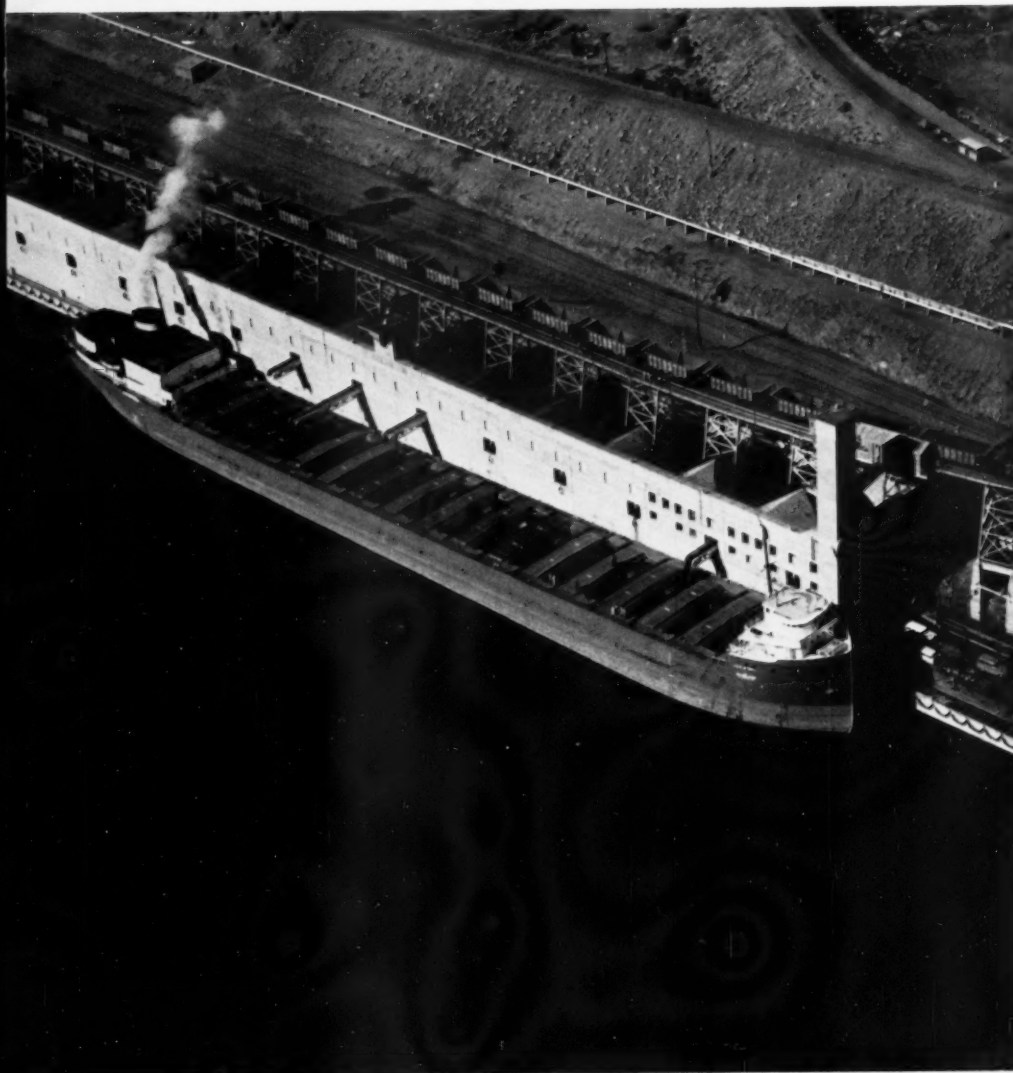


Compressed Air

MAY 1958

Magazine



ORE LOADING AT
TACONITE HARBOR
"J. R. Campbell" takes on first
full load of pelleted ore
for Erie Mining Company

VOLUME 63 • NUMBER 5

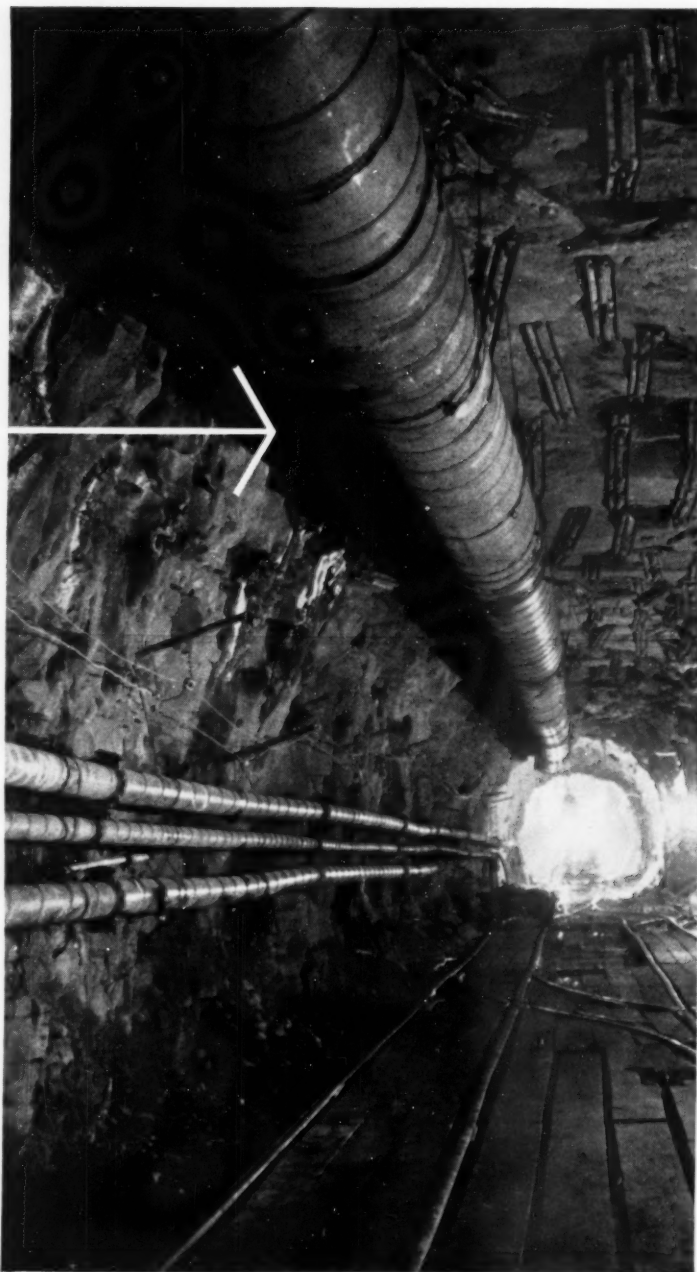
NEW YORK • LONDON

UNDERGROUND AIR EXPRESS

Speed is a *must* for tunnel construction—in moving fresh air where needed—in getting rid of smoke, dust and fumes—in pumping water—and in supplying air for pneumatic tools.

There's no better way to supply these vital needs than through lines of NAYLOR Spiralweld pipe. It's easy to handle and install because it's light in weight. It's easy to extend as work progresses, particularly with the one-piece NAYLOR Wedge-lock coupling to speed connections. Lines hug the wall and can be connected with only one side of the pipe in the open.

For all these services, you'll like the extra strength and safety built into NAYLOR pipe through the exclusive spiral-lockseam structure. For complete details, write for Bulletin No. 507.



NAYLOR

1245 East 92nd Street, Chicago 19, Illinois

Eastern U.S. and Foreign Sales Office 60 East 42nd Street, New York 17, N. Y.



DOLLINGER

ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Dollinger makes ALL TYPES of filters as shown on this page, plus special filters for unusual filtration problems. New users of one specific type of Staynew filters often find a second Dollinger filter performs a great,

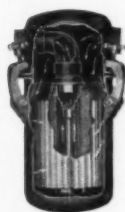
added service in other processes or operations. Dollinger maintains complete engineering, design and laboratory facilities for the development of special filters for new and unusual applications.

Write for complete information on any of the Staynew filters illustrated. Be sure to specify Bulletin Number or Numbers. Consult Dollinger Engineers on any special filtration problems—no obligation. Dollinger Corporation, 7 Centre Park, Rochester 3, N.Y.

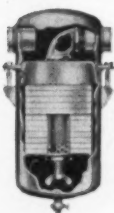
PIPE LINE FILTERS



Model CPH
Pipe Line Filter
Bulletin 200



Model CVH (Vacuum)
Pipe Line Filter
Bulletin 200



Model AAPHS
(Absorption)
Pipe Line Filter
Bulletin 200

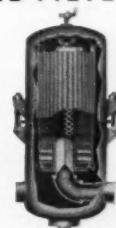


Model HPH and AHPH
(High Pressure)
Pipe Line Filter
Bulletin 200

LIQUID FILTERS

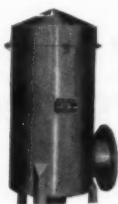


Model HE (Sump)
Liquid Filter
Bulletin 330



Model ELS (Pressure)
Liquid Filter
Bulletin 300

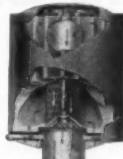
AIR INTAKE FILTERS



Model IDR
(Ground Level)
Air Intake Filter
Bulletin 100



Model DS (Silencer)
Air Intake Filter
Bulletin 100

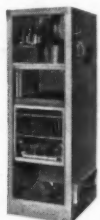


Model D (Outdoor)
Air Intake Filter
Bulletin 100



Model C (Indoor)
Air Intake Filter
Bulletin 100

VENTILATION FILTERS



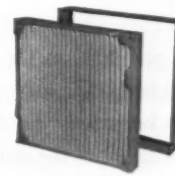
Electro-Staynew
Mist Collector
Bulletin 420



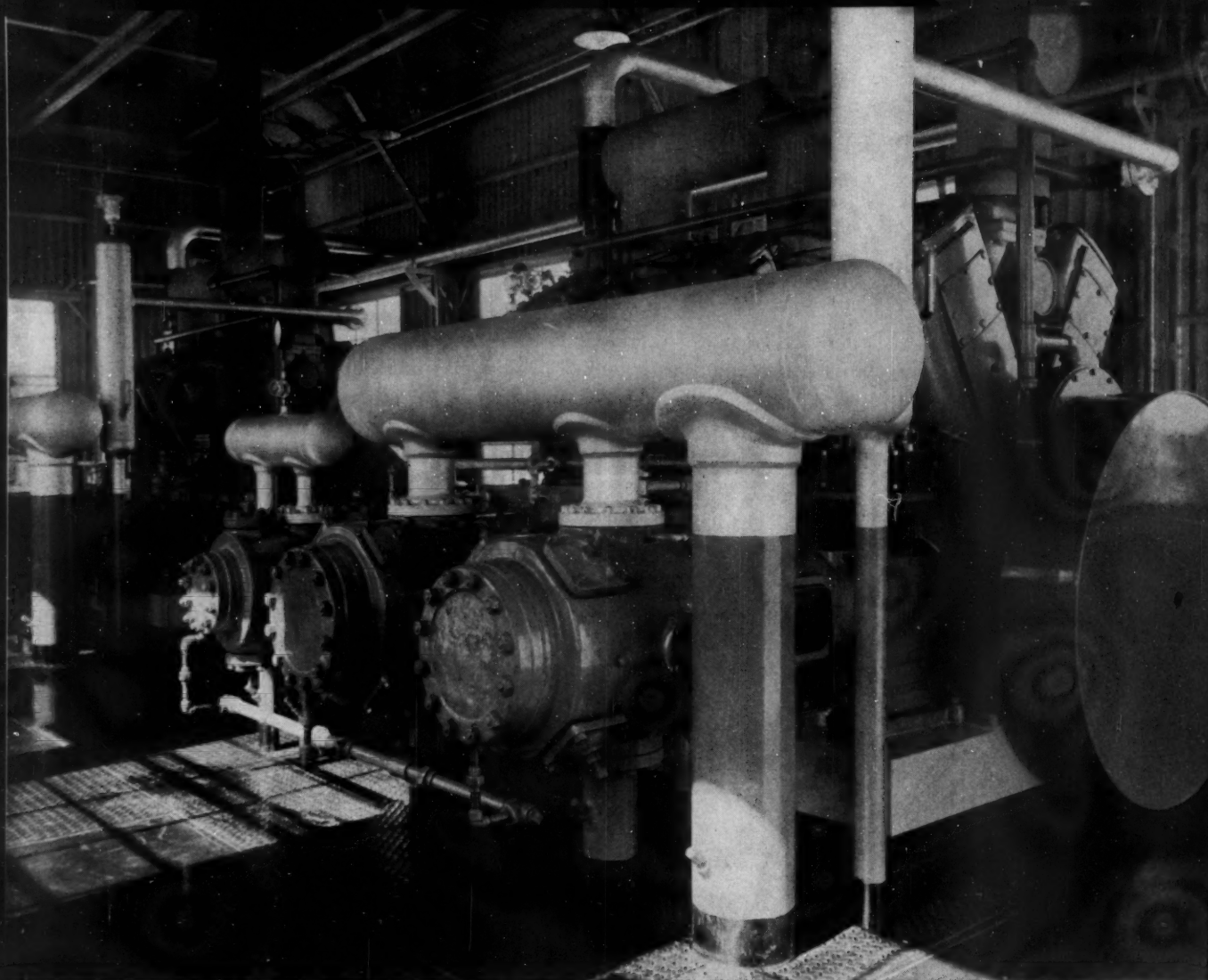
Electro-Staynew
Precipitator
Bulletin 400



Automatic
Ventilation Filter
Bulletin 500



Dry and
Viscous Panel
Ventilation Filters
Bulletin 600 and 700



No Rust and Sludge because... Texaco Regal Oil R&O keeps compressors clean

Additives in Texaco Regal Oil R&O prevent formation of rust and sludge, keep maintenance costs down. Valves and lines remain clear, and rings are free from harmful deposits. As a result, efficiency stays high... performance is always dependable.

There is a complete line of Texaco Regal Oils R&O, all refined to premium quality. Your Texaco Lubrication Engineer will be glad to help you select the right Texaco lubricants to keep *your* air compressing system clean. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.



LUBRICATION IS A MAJOR FACTOR IN COST CONTROL
(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

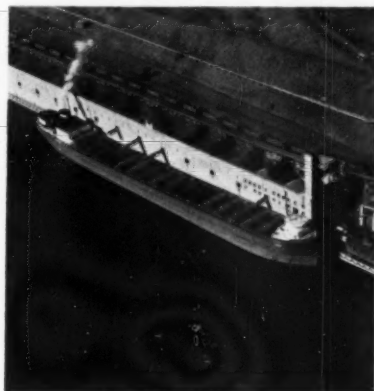
Compressed Air Magazine

Founded 1896

VOLUME 63 NUMBER 5

May 1958

R. J. Nemmers, *Editor*
S. M. Parkhill, *Assistant Editor*
C. H. Vivian, *Contributing Editor*
D. Y. Marshall, *Europe*,
243 Upper Thames St., London, E.C. 4.
F. A. McLean, *Canada*,
New Birks Building, Montreal, Quebec



ON THE COVER

IN 1948, Erie Mining Company put into operation a preliminary taconite pelletizing plant at Aurora, Minn. With the successful performance of the "pilot plant," the firm began construction of a large \$300 million pellet-making facility at Hoyt Lakes, a city built for families of Erie Mining employees. Taconite Harbor, shown on the cover, lies 80 miles north of Duluth and was built to handle the output of the Hoyt Lakes plant, 74 miles away via a newly built railroad. The dock at Taconite Harbor is 1200 feet long and incorporates the latest innovations in ore-loading equipment. Facilities include a 150,000-kw power plant.

FEATURE ARTICLES

Page 14 Multiple Nut Runner In Action—*Peter Sleight*

The use of highly efficient air-operated assembly machines is growing in American industry. Not only do the machines improve quality by eliminating some of the human element and providing more accurate torque control, but, as told in this story about Midland-Ross Corporation, they can reduce unit costs as well.

18 The Refining Of Corn,—Part I—*R. J. Nemmers*

Starch is a combination of carbon, hydrogen and oxygen molecules just as is petroleum. Corn refiners have learned to alter carbohydrates in much the same way as oil refiners make useful products from hydrocarbons. This first part of "The Refining of Corn" tells about corn starch and its by-products and uses.

23 Something About Selenium

One of the elements about which we actually know very little and yet one that we utilize in a great many ways is selenium. Some of the more interesting facts about the "moon element" are given.

25 The Conquest Of Rock

Without rock drills, few of the great engineering achievements of our age would be possible. Reproduced are twelve pencil sketches tracing the development of drilling equipment.

29 Bubble Chamber For A Bevatron

Liquefied gases form the basis for a means of studying the tiniest particles of matter.

30 When Is A Toy Not A Toy?

Working models are often the best way of examining new products. A recently developed model kit is reminiscent of a child's toy.

31 Gigantic Explosion Marks The End Of Ripple Rock

The world's largest nonatomic blast ripped out shoals near Vancouver Island, bringing to an end a series of marine tragedies.

DEPARTMENTS

- 16 Compressed Air At Work
- 32 This And That
- 35 Editorial—*Oiling The Wheels*
- 36 Saving With Air Power
Air Replaces Mud—Veterinary Surgical Table
- 37 Industrial Notes
- 42 Briefs
- 43 Industrial Books And Literature
- 51 Index To Advertisers

G. W. Morrison, *Publisher*

R. W. Sabora, *Manager*

J. W. Young, *Advertising Director*
J. J. Katarba, *Business Manager*
E. G. Andrews, *Advertising Manager*

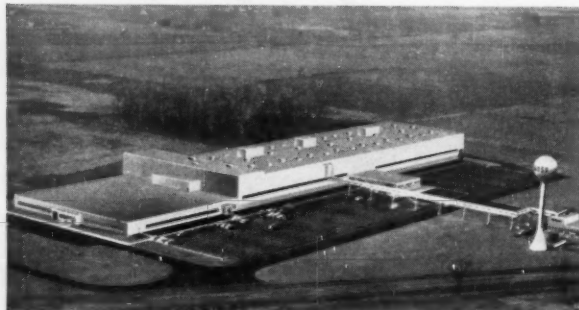
F. W. Hartman, *Circulation Director*
L. H. Geyer, *Representative*,
11 Broadway, New York 4, N. Y.

BPA

EDITORIAL, ADVERTISING AND PUBLICATION OFFICES, 942 MEMORIAL PARKWAY, PHILLIPSBURG, NEW JERSEY. COPYRIGHT © 1958 BY COMPRESSED AIR MAGAZINE COMPANY. ALL RIGHTS RESERVED. ANNUAL SUBSCRIPTION: UNITED STATES AND POSSESSIONS, \$3.00; FOREIGN, \$3.50; SINGLE COPIES, \$0.35. COMPRESSED AIR MAGAZINE IS INDEXED IN INDUSTRIAL ARTS INDEX AND IN ENGINEERING INDEX. MICROFILM VOLUMES (1940 TO DATE) AVAILABLE FROM UNIVERSITY MICROFILMS, INC. PUBLISHED MONTHLY BY COMPRESSED AIR MAGAZINE COMPANY: G. W. MORRISON, PRESIDENT; A. W. LOOMIS, VICE PRESIDENT; J. W. YOUNG, SECRETARY-TREASURER

THE CROSS COMPANY—Fraser, Michigan

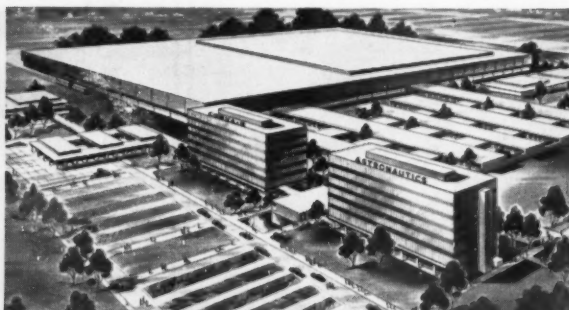
This automation equipment producer's new plant has two 12-million btu C-E Hot Water Boilers.



RIVERVIEW COMMUNITY HIGH SCHOOL—Riverview, Mich.
Two 10-million btu C-E Hot Water Boilers heat Riverview's recently expanded high school.

CONVAIR-ASTRONAUTICS—San Diego, California

New Convair space-flight research center has two 30-million btu C-E Hot Water Boilers.



U.S. AIR FORCE ACADEMY—Colorado Springs, Colorado
Choice of five C-E units here typifies widespread Air Force acceptance of high temperature hot water.

HIGH TEMPERATURE WATER

today's new idea in large space heating

In such diverse applications as industrials, large educational institutions, and military bases, high temperature water is finding rapidly increasing acceptance as an ideal means of heating large areas.

A big factor in bringing this trend about is The C-E La Mont Controlled Circulation Hot Water Boiler. Using the same principle as that applied by C-E in many of the country's largest utility boilers, this new boiler provides a degree of temperature control that makes it the most attractive method of heating in many cases. With a wide range of capacities—from 10 to 300 million Btu's—these boilers operate at water pressures up to 500 psi and temperatures to 470F, or higher. A C-E Hot Water Boiler can save from 10 to 20 per cent in maintenance and operating costs.

Combustion Hot Water Boilers in the smaller capacity range are completely assembled in the shop while the intermediate and large units are shipped in varying stages of assembly. This C-E practice greatly reduces erection costs.

So, if you are in the market for boilers, either for space heating or process requirements, it may prove greatly to your advantage to investigate the use of high temperature water as your heat source. Because individual needs vary, both steam and hot water have their place. Our engineers will be pleased to discuss either method with you or your consultants—impartially and with no obligation.

For further details on high temperature water boilers by C-E write for our catalog HCC-2.

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N.Y.
CANADA: COMBUSTION ENGINEERING-SUPERHEATER LTD.



C-120-8

ALL TYPES OF STEAM-GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE

DISTRICT OFFICES

BOSTON, MASSACHUSETTS

354 Washington St.
Wellesley Hills 82, Mass.
Phone Wellesley 5-6868

BUFFALO 21, N. Y.

P. O. Box 77
Phone Plaza 5820

CHICAGO 14, ILLINOIS

2701 N. Paulina St.
Phone Eastgate 7-8450

CINCINNATI 12, OHIO

2089 Sherman Ave., Room 53
Phone Jefferson 1-2855

CLEVELAND 14, OHIO

NBC Building
815 Superior Ave., N.E.
Phone Cherry 1-0862

DALLAS, TEXAS

Second Unit Santa Fe Bldg.
Phone Riverside 7-6966

DAVENPORT, IOWA

705 Union Arcade Bldg.
Phone 6-3133

DETROIT, MICHIGAN

6560 Cass Ave.
Phone TR 3-3262

ERIE, PENNSYLVANIA

12th & Cranberry Sts.
Phone 2-6436

GRAND RAPIDS, MICHIGAN

The Jay Wood Company
3251 Lake Michigan Drive N.W.
Phone Glendale 6-8391

HOUSTON 6, TEXAS

3302 Mercer
Jackson 3-5301

INDIANAPOLIS 18, INDIANA

1701 N. Sherman Drive
P. O. Box 7151

KANSAS CITY 11, MISSOURI

Room 5, V.F.W. Bldg.
406 West 34th Street

Valentine 1-0100

LANCASTER, PENNSYLVANIA

Williamson & Associates
P. O. Box 531-139 Nevins St.
Phone Express 4-1546

LOS ANGELES 22, CALIF.

Westco Pump Sales Co.
4621 Sheila Street

Phone Angelus 2-1155

MILWAUKEE, WISCONSIN

316 E. Silver Spring Drive
Phone Woodruff 2-7500-1

MINNEAPOLIS 4, MINNESOTA

The Edey Company
1302 Fifth Ave. South

Phone Federal 3-2813

NEWARK 4, NEW JERSEY

1245 McCarter Highway
Phone Humboldt 2-9233-4

Phone NYC Line Worth 2-7838

PHILADELPHIA 40, PA.

124 E. Easton Rd., Glenside, Pa.
Phone Turner 4-4668

PITTSBURGH 12, PA.

516 Federal St.
North Side Deposit Bank Bldg.

Phone Fairfax 1-4486

SAN FRANCISCO 24, CALIF.

Westco Pump Sales Co.
85 Industrial St.

Phone Valencia 6-5104-7

SEATTLE 44, WASHINGTON

H. S. Emanuels
1614 Stevens St.

Phone Franklin 2366

SKANEATELES, NEW YORK

P. O. Box 216
Phone 1093

TULSA 3, OKLAHOMA

Bekin Bldg., 20 East Archer St.
Phone Gibson 7-0520

WAUSAU, WISCONSIN

(Home Office)
Randolph & Cherry Streets

P. O. Box 630
Phone 2-2011-15

EXPORT DEPARTMENT

Marathon Electric Mfg. Corp.
431 Fifth Ave.

New York 16, New York
Phone Murray Hill 5-3322

Call Any Of The
Above Offices For
Complete Information

why you should specify



MOTORS and GENERATORS

DEPENDABILITY

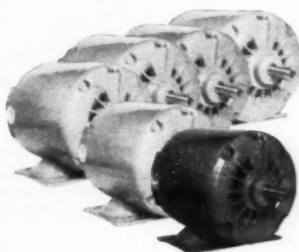
accepted by Leading National Manufacturers

WIDE RANGE OF SIZES

motors 1/20 H.P. to 2500 H.P. Generators 1/2 K.W. to 2000 K.W.
built to your specifications

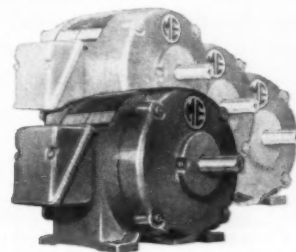
NATIONWIDE SERVICE

A Service Station and District Office is near you



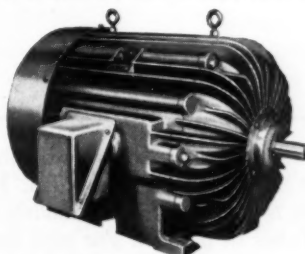
FRACTIONAL H.P. MOTORS

General Purpose
1/20 HP-up From Stock
Special Purpose:
Built to YOUR Specifications



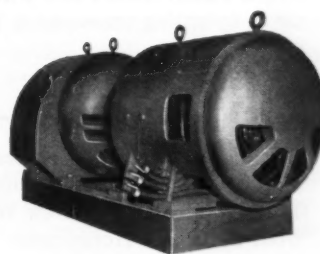
NEW NEMA INTEGRAL HP MOTORS

Provide 4 in 1 Protection:
Drip-proof . . . Splash-proof
Weather Protected . . . Guarded.
All at Open Motor Prices



TOTALLY ENCLOSED FAN-COOLED MOTORS

Ribbed Frame Construction:
Cool, Clean Efficient
Explosion Proof Ratings to 250 HP
Carry UL Label



LARGE APPARATUS

Synchronous & Wound
Rotor Motors
Generators AC, DC HI-
Frequency
Motor-Generator Sets
Automator-Adjustable Speed
Drives

MARATHON

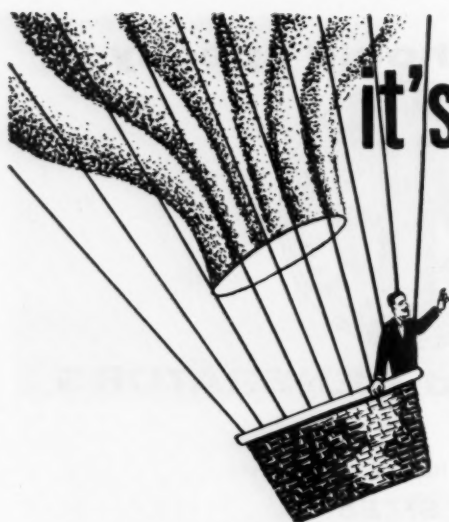
Home Office and Factory,
Wausau, Wis.



ELECTRIC

Factories at Erie, Pa. and
Earlville, Ill.

SALES OFFICES IN PRINCIPAL CITIES



it's **HIGH** time you tried *Fulflo Filters* for

HIGH EFFICIENCY

Fulflo Filters for compressed air, minimize gumming — remove moisture, oil, microscopic rust, dust and scale from your air lines. Single-tube B-A model has 3, 5 or 7-inch Honeycomb Filter Tubes for 10, 30 and 60 cfm at operating pressures up to 125 psi. A-F model has flow rate of 60 cfm at operating pressures up to 250 psi.

HIGH PRESSURE

This rugged filter withstands operating pressures up to 4000 psi. Flow rate is 1.5 cfm at 4000 psi — the equivalent of 410 cfm of free air.

HIGH CLEANLINESS

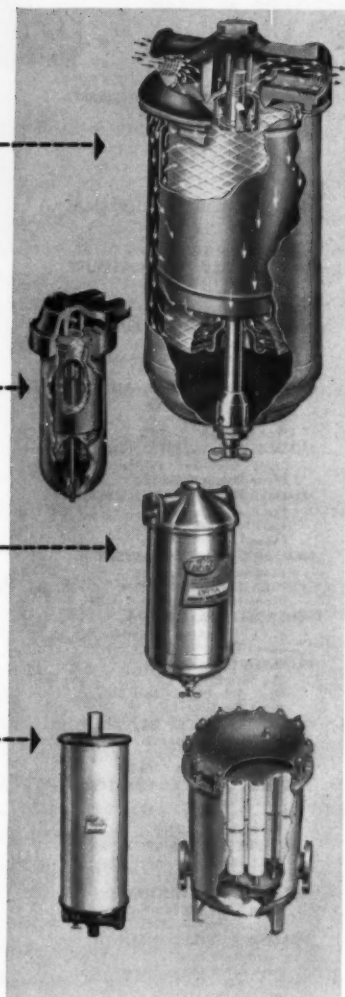
New nickel-plated brass filter is completely sanitary and non-rusting. 7-inch Honeycomb Filter Tubes have flow rate up to 76 cfm of free air at operating pressures of 100 psi.

HIGH CAPACITY

For high flow rates or central installations, WY models have three, six, twelve or eighteen Honeycomb Filter Tubes in parallel. For 1½ and 2-inch pipes. New WH model is made in thirteen models — from 24 to 270 Honeycomb Filter Tubes in parallel. For pipe sizes from 2 to 6 inches.

Fulflo Filters are rugged and durable. Honeycomb Filter Tubes are low in initial cost, economical in maintenance-free operation and exceptionally long life.

With Fulflo Filters, the quality is **HIGH** — the price *low*.
Write for new catalog to Department CA.



COMMERCIAL FILTERS CORPORATION

MELROSE 76, MASSACHUSETTS

PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

MICRO-CLARITY AT MINIMUM COST



with genuine Honeycomb Filter Tubes for controlled micro-clarity of industrial fluids.



Selective filtration of oils • water-oil separators • magnetic separators • pre-coat filters • coolant clarifiers • automatic tubular conveyors.



DRAWPOINTS VS. CHUTES — EIMCO 630 SAVES 1/3 OF COST

Recent cost figures made available to the Mining Industry show conclusively that drawpoints have an advantage over gravity run muck through chutes.

This information is difficult to obtain in any mine, but many have been able to develop two areas in a single mine and have developed one for drawpoint, and one for chute systems.

Of the many interesting facts established during these projects, it has been amazing how much faster the drawpoint setup gets into production. It has also been difficult to believe how much savings are effected through the use of drawpoints.

In spite of dropping the muck to the floor and then picking it up again — costs have consistently

been from 1/3 to 1/2 less by using the drawpoint method.

Obviously, only the best, most dependable equipment can be used in such an operation. That's why all successful drawpoint loading operators use Eimco loaders.

The 630, used in the operation pictured above, reduced costs from approximately 42¢ per ton to approximately 27¢ per ton. The savings of 15¢ pays for the equipment in a relatively short period of time.

You can save on loading costs, too. Use the only thoroughly tested and proven loading equipment. Write Eimco for information.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N.Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa



B - 321



This 110-B shovel digs and loads out 4,500 yards of copper ore and overburden every 8-hour shift in a western copper mining operation.

Get INSTANT EXTRA TORQUE to meet every load

Pace-setting Bucyrus-Erie mining shovels give you an electrical control system that speeds acceleration and deceleration on every move, gives instant, extra torque to meet the load, speeds every work cycle.

It's the Bucyrus-Erie improved Ward Leonard variable-voltage control system—job-proved and famous for outstanding results in major open pit mines all over the world.

Your operator commands every operation

with well-grouped, simple controls for exceptionally smooth digging, swinging, hoisting, and propelling action. When you want speed . . . or torque . . . you GET it!

The result is more pit output at lower cost. Less mechanical and electrical maintenance, too. Write today for the complete story of these big Bucyrus-Erie electric mining shovels—4½-yd. 110-B, 6-yd. 150-B, 8-yd. 190-B. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

191L58



MODERNIZE to economize!

COPPUS "BLUE RIBBON" VENTILATORS

identified by the blue band

FOR WORKERS'

- Safety
- Health
- Comfort
- Efficiency

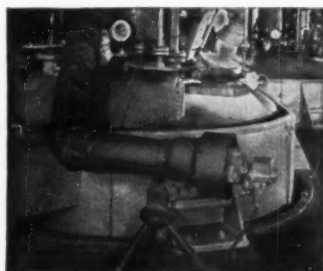
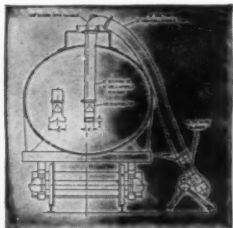
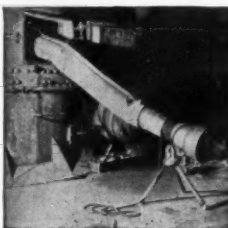
VANO Design "A" VENTILATOR



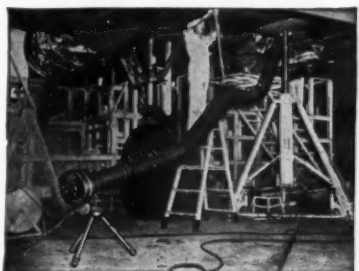
Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during repair work.

Vano Design "A" delivering fresh air to cable manhole, expelling sewer gas, making entrance safe in a few minutes.

Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.



Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.



Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.

Powered by a 1/2 hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

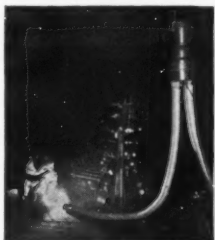
VANO DESIGN "C"



VENTILATOR-EXHAUSTER



Vano Design "C" equipped with 8" discharge tubing removing welding fumes.



Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ... or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ... or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a 1/2 hp motor, it weighs only 85 lbs.

COPPUS ENGINEERING CORP., 205 PARK AVENUE, WORCESTER 2, MASS.

Please send information on the Blowers that clear the air for Action.

- | | | |
|--|--|---|
| <input type="checkbox"/> in tanks, tank cars, drums, etc. | <input type="checkbox"/> on steam-heated rubber processes. | <input type="checkbox"/> general man cooling. |
| <input type="checkbox"/> in underground cable manholes. | <input type="checkbox"/> on boiler repair jobs. | <input type="checkbox"/> around cracking stills. |
| <input type="checkbox"/> in aeroplane fuselages, wings, etc. | COOLING: | <input type="checkbox"/> exhausting welding fumes. |
| <input type="checkbox"/> on coke ovens. | <input type="checkbox"/> motors, generators, switchboards. | <input type="checkbox"/> stirring up stagnant air wherever men are working or material is drying. |
| | <input type="checkbox"/> wires and sheets. | |

(Write here any special ventilating problem you may have.)

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

COPPUS "BLUE RIBBON" PRODUCTS—Designed for Your Industry, Engineered for You

NEW Ingersoll-Rand ESH IN DESIGN



ESH

(vertical) *

ESH

(horizontal) *



*The same compressor in either horizontal or vertical arrangement— 20 to 150 hp sizes, single- and multi-stage, pressures up to 5000 psi and vacuums.

and ESV compressors...

AND PERFORMANCE

...with heavy-duty features proven in larger Ingersoll-Rand Compressors

Here's an entirely new line of compressors, built to run longer—much longer. They're more compact, more efficient, and require less attendance, less maintenance. They offer greater capacity in less space, and are ruggedly built and highly refined to take years of continuous hard service. The ESH and ESV are part of the modern generation of the Ingersoll-Rand compressor family—a family 80 years young.

Never a need for adjustments—frame is kept sealed! All running parts are precision-machined and need no fitting or adjusting, so the frame is sealed—dirt stays out, and the major causes of wear are eliminated!

• **Full-floating aluminum bearings never need adjustment**



The full-floating bearings "roll with the punch" taking each major thrust on a different portion of the shell. They are fool-proof, and never require fitting or adjustment. Main and crank-pin bearings are made

of I-R's special aluminum bearing alloy, which has higher load capacity and better heat conductivity than other bearing materials.

• **Air-cushioned Channel Valves give unmatched performance**



Known the world over for lasting efficiency, dependability and quiet operation, Ingersoll-Rand air-cushioned Type A Channel Valves are entirely different in design and principle from any other valves in use. Type A Chan-

nel Valves were developed especially for modern compressor speeds, and feature a separate stainless steel seat plate which can be reversed or replaced for new life.

There are many other design features—including filtered force-feed lubrication and full-floating, self-adjusting metallic packing—that have heretofore been found only in larger Ingersoll-Rand compressors. Let your I-R representative tell you more about these new compressors for air or gas, and how they can save you money.

Ingersoll-Rand
I-814

11 Broadway, New York 4, N. Y.



IN ENGINEERED PRODUCTS, THERE'S NO SUBSTITUTE FOR EXPERIENCE!

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

On the roughest SEALTITE electrical

against oil, grease, water, dirt, chemicals, corrosive fumes, salt spray, weather.

SEALTITE is a flexible and liquid-tight electrical conduit. It gives maximum protection to your wiring when it must connect moving parts, absorb vibration, follow machine contours, flex into U-bends, be easily maintained or be safeguarded between misaligned outlets.

It is being used successfully in wet locations, in tunnels, power plants, steel mills, canneries, chemical industries and in many outdoor applications. Sealtite comes in three types:

TYPE U. A.— Specifications for Type U. A. (Underwriters' Laboratories Approved) and Type C. S. A. (Canadian Standards Association Approved). Construction: flexible galvanized steel core, positive ground and tough extruded outer cover.

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.484	.504	.690	.710	6	30.0
1/2	.622	.642	.820	.840	7	36.6
3/4	.820	.840	1.030	1.050	10	48.2
1	1.041	1.066	1.290	1.315	12	87.7
1 1/4	1.380	1.410	1.630	1.660	15	116.5

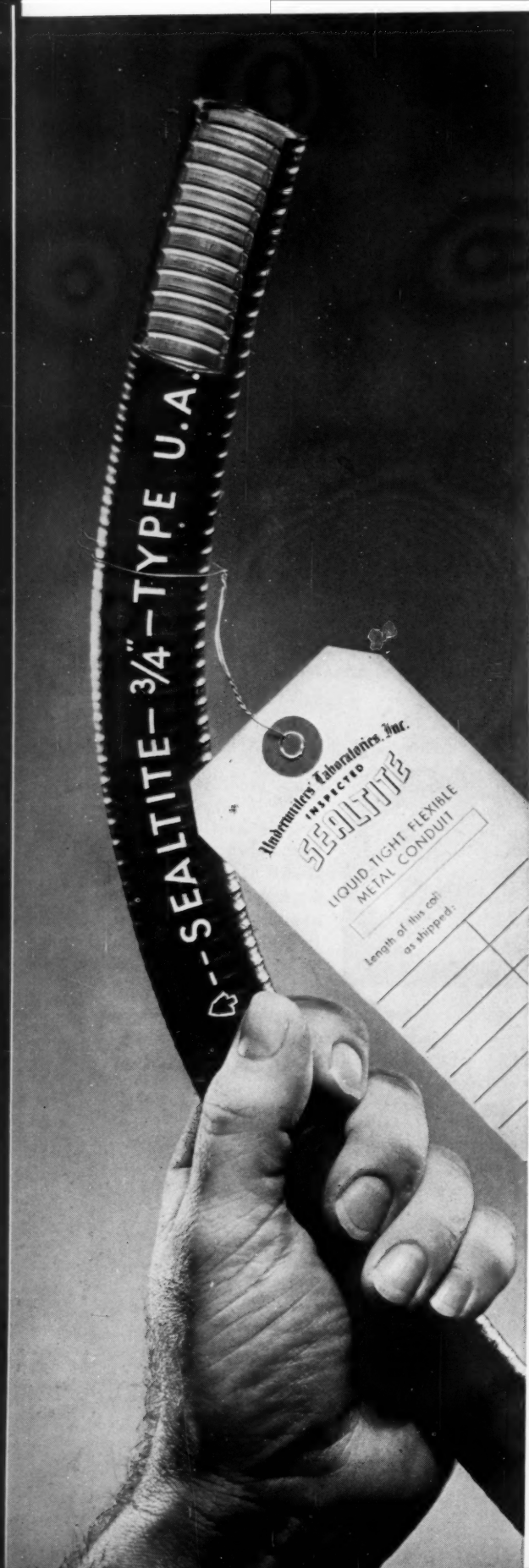
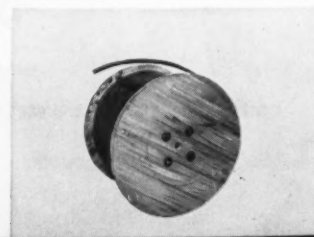
TYPE E. F. † (Extra Flexible)—for machine tools and industrial equipment. (Meets standards set by J.I.C.)

TRADE SIZE	INSIDE DIAMETER		OUTSIDE DIAMETER		APPR. INSIDE BEND DIAM.	EST. WGT. (Lbs. Per 100 Feet)
(Ins.)	Min.	Max.	Min.	Max.		
3/8	.485	.500	.695	.710	5	24
1/2	.620	.635	.825	.840	5	29
3/4	.815	.930	1.035	1.050	6	39
1	1.030	1.050	1.295	1.315	8	67
1 1/4	1.370	1.390	1.635	1.660	10	87
1 1/2	1.575	1.595	1.875	1.900	12	105
2	2.020	2.040	2.350	2.375	15	135
2 1/2	2.480	2.505	2.850	2.875	20	198
3	3.070	3.100	3.470	3.500	26	282
4	4.000	4.040	4.460	4.500	34	414

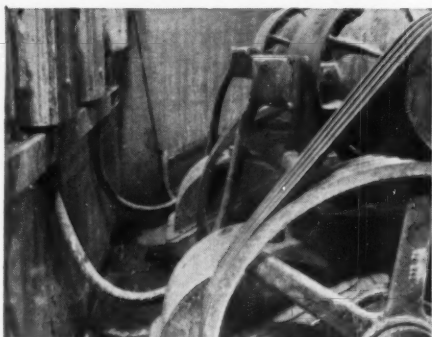
Commercial tolerances apply on above figures.

ELECTRICAL WHOLESALE stock Sealtite. Buy it in long, random lengths on nonreturnable wooden reels, at no extra cost. Available in sturdy cartons that are easier to store and carry to the job. Liquid-tight connectors also are available from wholesalers' stocks. For information write: The American Brass Company, American Metal Hose Division, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.

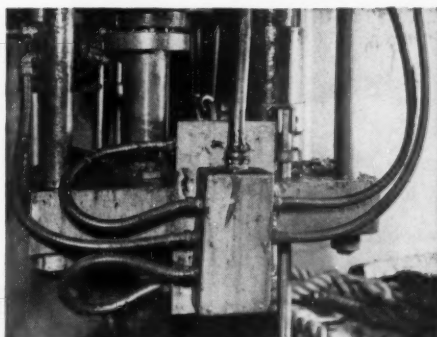
†Pat. applied for 58182



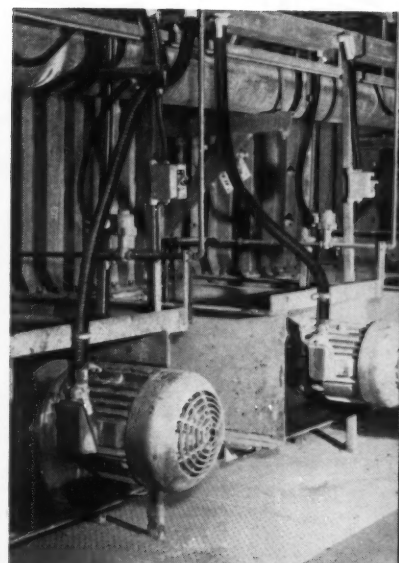
jobs in your plant conduit protects wiring



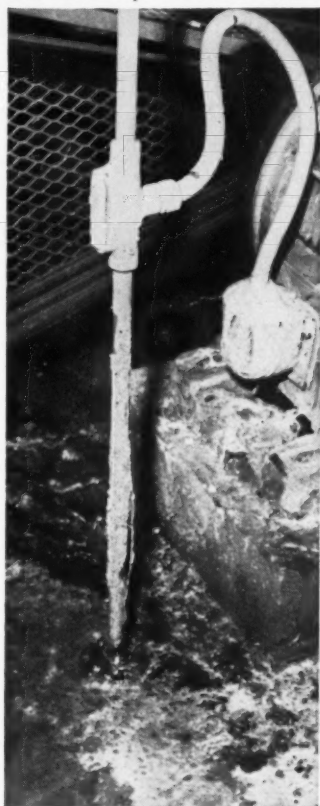
ABRASIVE GRIT around these sand pumps in a rod and ball mill pit can't faze Sealite.



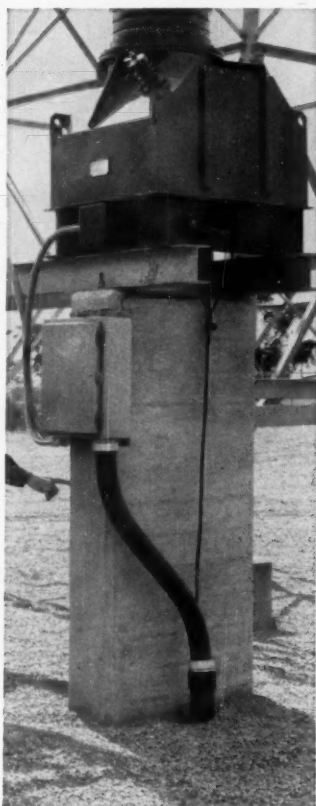
OIL, GREASE, WATER constantly cover these Sealite control connections. Still no trouble.



BOILER HEAT and 6-inch expansion rise are easy service for Sealite.



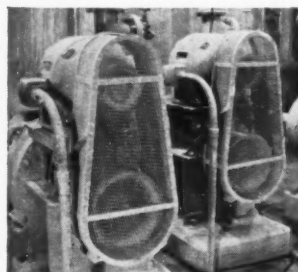
CHEMICALS. Sealite shrugs off hot chlorine vapors in this plant—another example of its ability to resist chemicals and corrosive fumes.



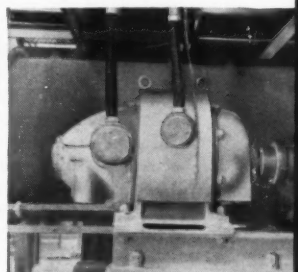
WEATHER. Install Sealite outdoors. It stands up under tropical sun and heat, rain, ice, and arctic cold. Protection is complete.



ON MOBILE EQUIPMENT Sealite can take up movement, withstands weather, dust, vibration. It's fast and easy to install.



MOVEMENT AND VIBRATION that would crack rigid conduit are absorbed by Sealite on connections for these tailings pumps.



ABRASIVE DIRT AND VIBRATION at this ball mill motor are tough enemies—but Sealite can take it.



CUTAWAY SECTION of Type U.A. Sealite shows tough polyvinyl jacket over flexible metal core. Copper conductor wound spirally inside conduit gives positive ground.

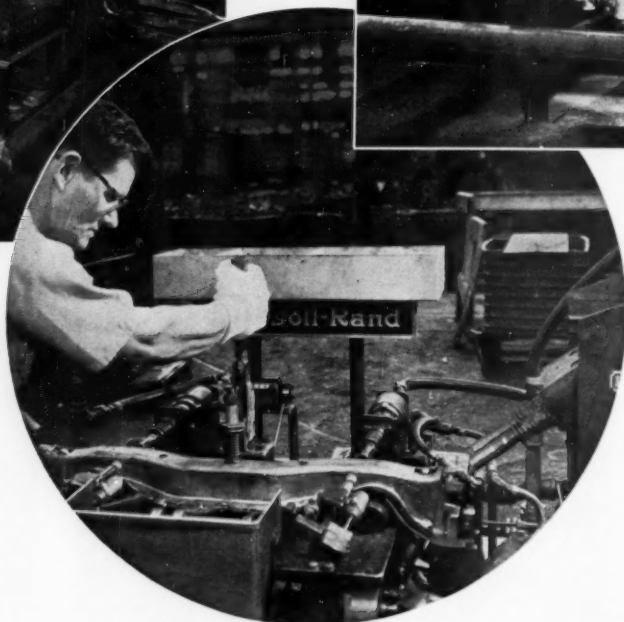
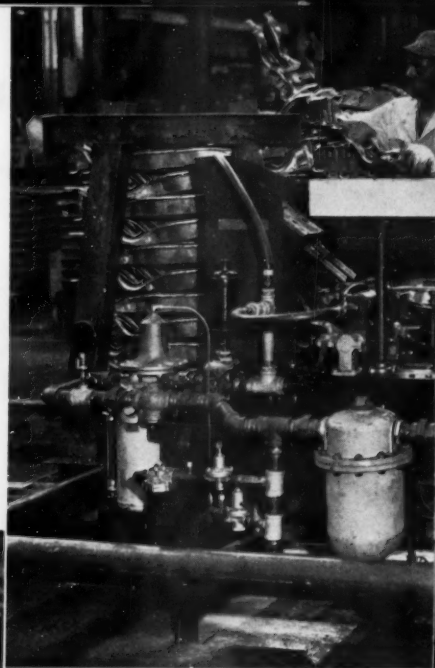
*Insist on
the conduit marked*

SEALTITE®
FLEXIBLE, LIQUID-TIGHT CONDUIT

an **ANACONDA®** product

INSPECTION OF COMPLETED WORK

An industrial engineer at Midland-Ross Corporation and a foreman at the facility are shown below inspecting a completed support piece. Each consists of a main bar and two end brackets. In the background can be seen the Ingersoll-Rand unit in operation.



USE of automation to increase output has given way to a new trend—the use of automated production facilities to reduce unit costs.” This is a statement made by Roger W. Bolz in his February editorial in *Automation*. It can be brought into meaningful focus by looking at a specific application.

Midland-Ross Corporation, Detroit, Mich., manufactures and assembles rear engine-support bars for one of the “big three” automobile makers in the United States. It reports that operation unit costs are currently down by 40 percent and, at the same time, production is moving at the rapid rate demanded by the ever-changing, dynamic automobile industry. The reason for this saving is that a conversion has been made from hand-assembly methods to semiautomatic ones utilizing an air-operated assembly machine.

At the time when the entire support bar units were assembled manually, two crews of seven men each, working two 8-hour shifts, were required. They consisted of five preassemblers and two impact-wrench operators, and the group logged a total of 224 man-hours per day.

Frequently, the seven men would be idle for a variety of reasons, one of the most common being the replacement of wrench sockets. Since their walls were ground down to enable them to be inserted into close areas of the assembly, they were inherently weak and would not hold up when subjected to Impact-tool service. Such shut-downs occurred about once a day and would last, on the average, 45 minutes, thus idling all seven employees. Consequently, the

facility was paying wages for 5¼ non-productive man-hours per day, not to mention the cost of replacing the sockets. Furthermore, using as a guide the number of completed assemblies that could be turned out while the wrenches were in operating condition, the stoppage meant that a potential 75 units per day were never produced. Like so many manufacturing facilities, particularly those connected with the standardized

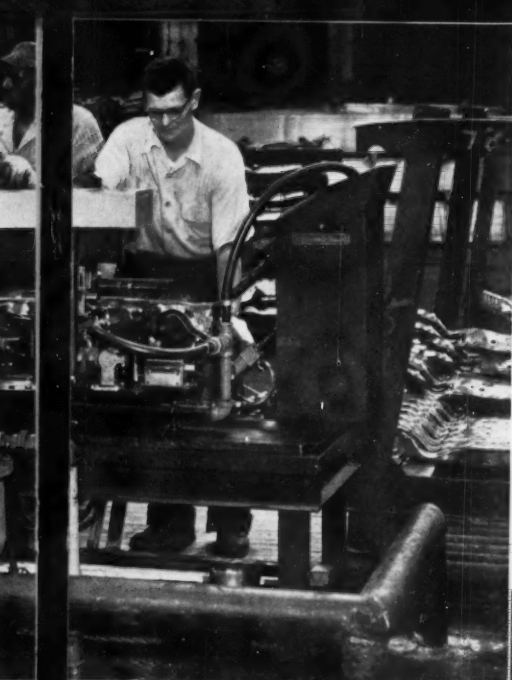
automotive industry, downtime at any one point, if extended, could affect the entire plant; the Midland-Ross production process was geared, in this case, to a 1600-finished-units-per-shift rate.

With this general problem confronting them, Midland-Ross called Ingersoll-Rand engineers to help work out a solution. After a close study of the situation and the production operation, a new machine was designed to meet all the

MULTIPLE NUT RUNNER IN ACTION—

In Automotive Subassembly Operations At Midland-Ross Corporation

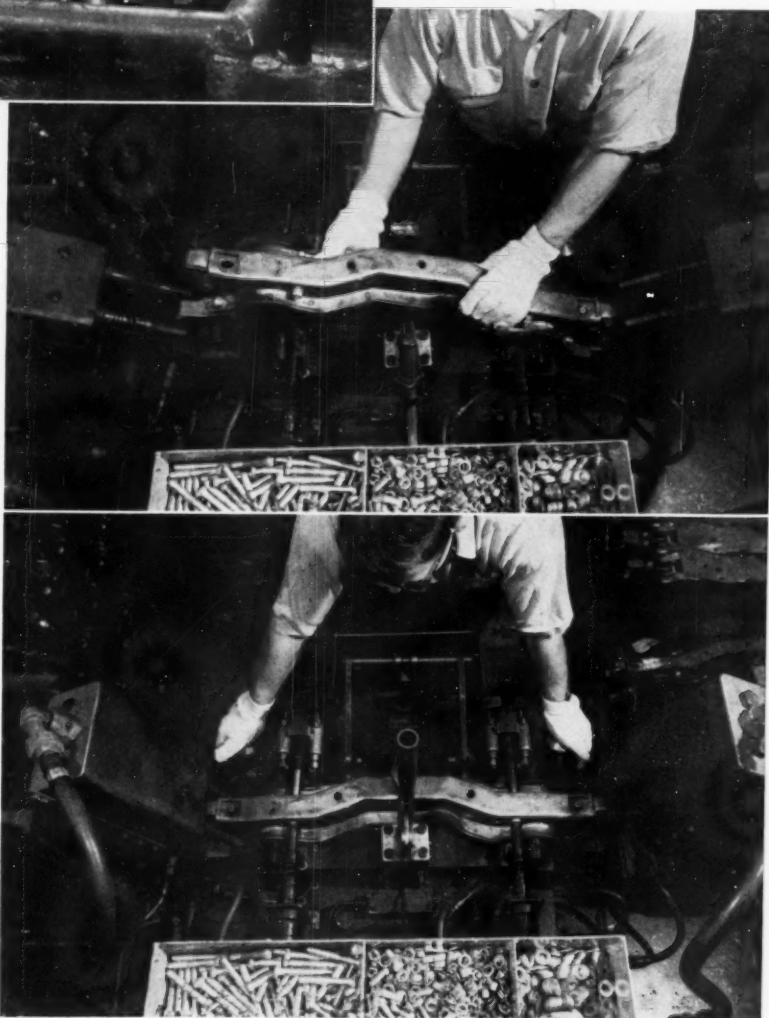
Peter Sleight



particular requirements. It was designated as Model SC6 and could drive six bolts at a time to a torque of 50 foot-pounds with a plus-or-minus tolerance of 5 foot-pounds. Prior to delivery, exhaustive tests were made on the actual

NUT RUNNER FROM TWO POSITIONS

The photograph at the left shows Ingersoll-Rand Company's Model SC6 multiple nut runner from the back. At the left, a helper is preparing to place a bar in position before the operator presses two controls which actuate the six socket-equipped spindles. The view in the circle is from the operator's position. The unit measures but $5\frac{1}{2} \times 2\frac{1}{2}$ feet, and including receiving and shipping rollers, keeps the assembly area to a compact 10×20 -foot size.



CLOSE-UP VIEWS

The operator places a crossmember of the 3-part support-bar assembly on the machine (center above). When he simultaneously presses the controls, the SC6 automatically runs the bolts within a plus-or-minus 5-foot-pound tolerance of the desired 50-foot-pound torque (directly above). Only 4 seconds elapse from the time he presses the controls until the tools stall. Including the placing and removing of the parts, each run requires 15 seconds.

production routine used by Midland-Ross. Once passed, the equipment was installed.

The assembly machine is compact, measuring only about $5\frac{1}{2} \times 2\frac{1}{2}$ feet, and enables the centralization of the assembly efforts. (Including the space required by rollers for receiving and shipping, the total area requirement is but 10×20 feet.) Prior to the installation, work covered a much greater area. Now, two men can work in final assembly at one location.

Each rear engine-support bar has three parts—two end brackets and a main bar. These come to the assembly station in tote "horses." Two crews put the units together by hand, assembling three bolts each, locking them, finger tightening the nuts and placing the loose units into racks. Each rack has a capacity of about 200 pieces. These are next delivered to the Ingersoll-Rand unit that drives the nuts to the proper torque. The bars are then sent down the production line where they are installed on frames.

After a helper places the bar in position on the unit, the operator presses two controls that actuate the six socket-equipped spindles. Air cylinders pull the spindles onto the bolts, and they are driven to the specified torque. Both of the operator's hands must be on the controls before the machine will start its cycle. Because each component tool in a machine such as the SC6 is identical with every other one, and since the air is fed to them through a common back-head, they all stall at the same resistance, thus doing the same amount of tightening. Stalling does not harm the equipment.

The time required for the operation, from the pressing of the controls until the stall is realized, is but 4 seconds. Two thousand bars can be turned out in every 8-hour shift. Including the time necessary for the placing and removing of the workpieces, the machine has a production rate of four bars per minute. In finishing 2000 units in one 8-hour shift, required production figures are easily maintained. Four men are released for vital work in other parts of the plant. Because of its high-production capacity, only one assembly machine is in operation and takes a total of only 192 man-hours daily to accomplish the same amount of work that formerly required 224 man-hours.

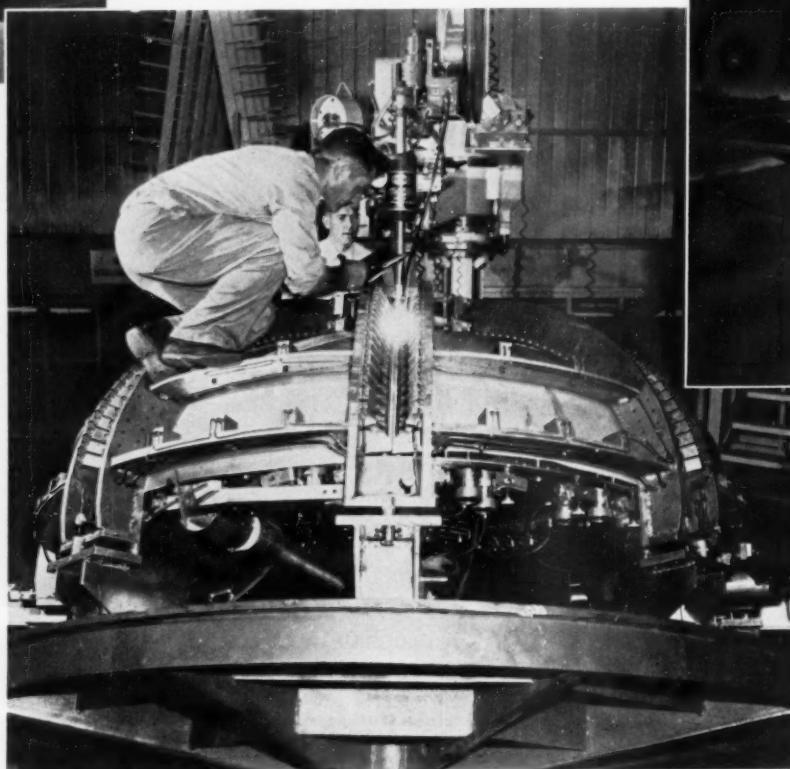
Working more than twice as fast as the manual operation that it replaced, the semiautomatic Model SC6 has eliminated a daily 32 man-hour labor charge. It further requires new sockets only once for every ten replacements needed by the hand-operated impact wrenches. Considering these savings, the company reports that the SC6 paid for itself within the first 2 full months of production.

The device shown at the right was developed by Boeing Airplane Company, Seattle, Wash., to expedite the painting of such small parts as washers, clips and spacers. It utilizes a revolving wire-cage drum into which the parts are loaded. An extremely fast-drying paint is sprayed over them, and air blasts during the operation keep the workpieces from sticking together. It requires only 3 minutes from the time the parts are placed in the tumbler until they can be removed. Formerly, 3 hours were required to do the same job, for parts had to be spread out on a screen so that they would not touch each other, sprayed on one side and then turned over for respraying.



Evidence that musicians can make use of compressed air power, as well as industrialists, is illustrated above. The photograph shows a pneumatic guitar that was invented by Felix Barrel, a Paris night club musician. Although the body of the instrument is completely collapsible, it can be inflated for performances and produces normal sounds.

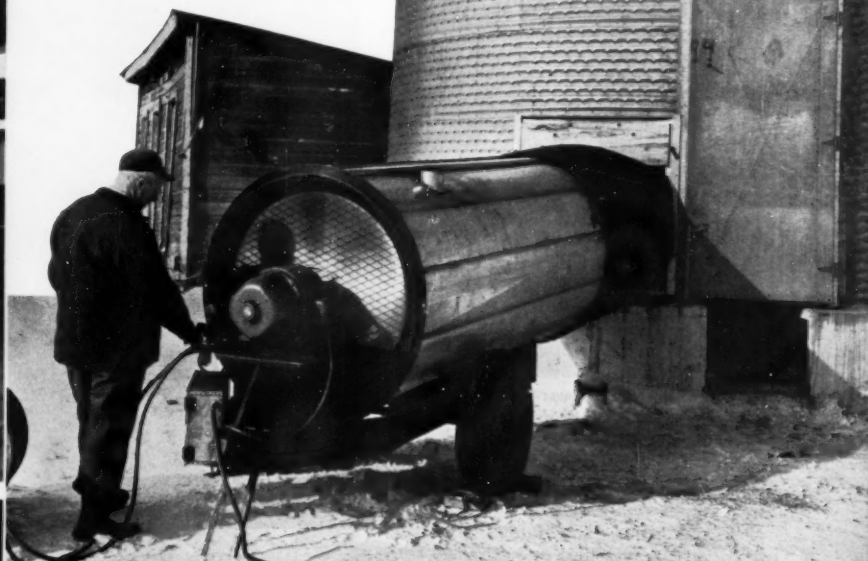
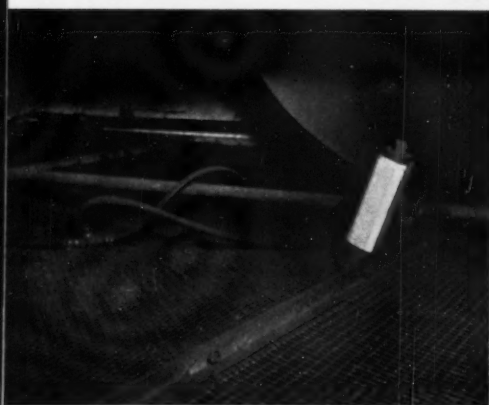
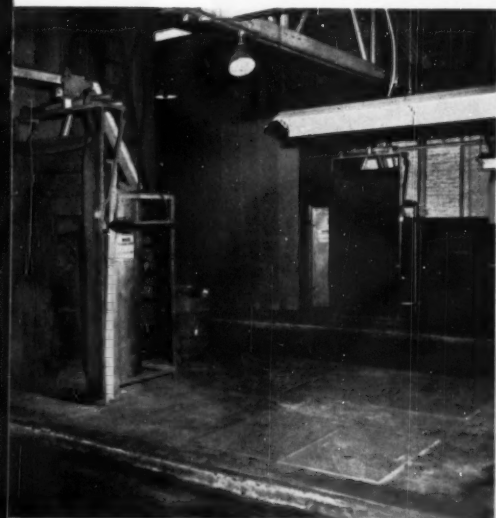
A special fixture holds orange-peel-shaped aluminum sections as they are automatically joined by Heliwelding, an inert-gas arc welding process. These parts form a portion of the fuel tank for Titan, an Intercontinental Ballistics Missile being built by The Martin Company, Denver, Colo., for the U. S. Air Force. Air Reduction Company, in conjunction with sub-contractors, designed and engineered the fixtures, rotating device, loading mechanisms and other parts of the machine tool. All phases received design and engineering emphasis to assure ideal results. Pneumatic hold-down fingers that are actuated by 90-psig pressure, for example, were utilized to align the sections within close tolerances throughout the welding process. The unit illustrated is said to be the largest precision welding tool installation ever engineered in the United States.



The Chicago (Ill.) Transit Authority has an efficient way of cleaning its buses that utilizes both vacuum and air power. A huge, accordion-like frame (top right) closes on the open door of a bus. When it is tight, a Buck Cyclone Cleaner, as it is called, starts its work, drawing out dirt, dust, newspapers and similar trash. The debris is then blown into a large bin where it is pulled to, and caught against, a screen on the top while the air continues to pass through. As the trash becomes entangled, it interferes with the air flow. To prevent this, pneumatic vibrators (below right), manufactured by The Cleveland Vibrator Company, were attached to the mesh work of each trash bin. These joggle the screen between bus cleanings, knocking all the litter to the floor.

COMPRESSED AIR AT WORK

By forcing hot air into a crib of corn, Clare Backus of Charlotte, Mich., dries the grain to realize preseasonal above-market prices. Air is forced into the bottom of the crib where it circulates and is dissipated, with the moisture, through the sides and top. After harvesting a crib-load of corn, the moisture content was found to be 34 to 40 percent. Using an oil-burning crop drier, he was able to drop it to less than 13 percent in approximately 48 hours. ➡



➡ Seven truck-mounted cranes, such as the one illustrated at the right, are used by Wisconsin Natural Gas Company for leak-repair work. Each has a 3-man crew and reportedly saves a considerable number of man-hours. The compartment behind the cab houses the unit's air compressor and provides tool storage space. Pavement is broken with a jackhammer, holes are driven into the trouble spot and a pit, averaging 2x6x5½ feet, is dug with the clamshell bucket swung by the crane. Thus, the men do not have to dig in gas-filled pits. When the job is finished, the 2-ton Hydro-crane can be moved rapidly to new work sites.

THE GOLDEN GRASS

R. J. Nemmers

CORN is by far the most important crop harvested in the United States. In acres devoted to its production, bushels of the grain harvested, dollar value, or even sheer weight, it is far ahead of any other cultivated plant. It is the backbone of the American food industry: beef, milk, pork, eggs, poultry, even candy, depend on it. The annual harvest of the shelled grain—not counting cobs—averages nearly 3 billion bushels, about three times the production of wheat.

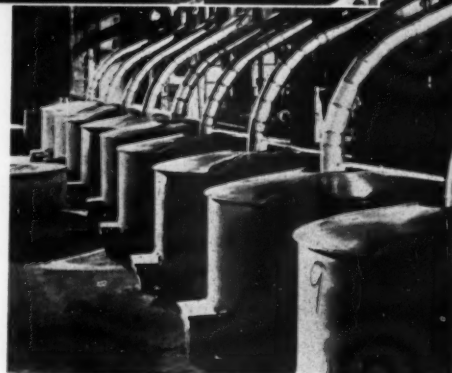
Corn originated in the Western Hemisphere and was not known in the Old World until Columbus' explorations. The word *corn* was known in Europe long before the discovery of America, however; it even appears several places in the Bible. It meant grains in general, and when the colonists came to this country, they applied it to the specific Indian plant. Indeed, in Europe, corn was known as Indian corn until 1753 when Linnaeus, the famed Swedish scientist who classified and renamed the plants of the world, coined the term *zea mays* for it. It was an interesting marriage of two far different tongues, for the first part comes from the Greek term meaning "grain" and the second, from the sound common to most American Indian tribes meaning "that which sustains life." Even today, most Europeans cling to the ancient general meaning of corn and refer to the specific grain as maize.

Corn is a member of the grass family, and some scientists believe that they have traced its genealogy to a wild grass that existed some 60,000 years ago. The cultivated form of corn has been grown for centuries—an ear estimated to have been harvested about 2000 B.C. was found several years ago in Mexico's Bat Cave. In its years of dependence on man for weeding and planting, corn has evolved to a state reached by few other plants: it cannot return to the wild, and if man were to cease its cultivation, corn would disappear from the earth. Human hands are needed to plant the big seeds at properly spaced intervals; if laid down too closely, as it would be if untended, the resultant crowded growth would produce only grass-like leaves of great size



BUHR MILLS

To separate starch from the corn hulls, the macerated pulp from the degerminating process is fed to the fluted, siliceous-stone mills shown above. The two halves rotate in opposite directions, pulp entering in the center and being discharged at the periphery. The action is actually more of a rubbing, rather than a literal grinding. A battery of ten mills is shown at the right.



and not the ears that bear the seed for a new generation.

Every state in the United States has a corn crop; two-thirds of all farmers raise the grain. Although it is unusually hardy and can survive in climates ranging from the arid heat of southwestern United States to the cool nights of the Andean mountains, it does best in rich, fertile, well-drained land where plenty of rain falls and the summer days and nights are hot and humid. The so-called corn belt is such an area. Encompassing about 377,000 square miles and including all of Iowa, Illinois and Indiana, as well as adjacent sections of neighboring states, the region is well named. There, 75 percent of America's corn is raised, 40 to 45 percent of the world's.

Although once a staple food for Amer-

icans, comparatively little corn, as such, is directly consumed by people in the United States today. About 90 percent of all that is grown is fed to livestock. Almost 10 percent, divided almost equally, is used by three major industries. Distilleries convert it to alcohol, both for beverage purposes and for chemical needs. Dry millers use it in the production of breakfast foods, corn meal, hominy and the like. Wet millers, or corn refiners, turn out starches, corn sugars and syrups, oils, dextrins and a variety of other products.

The corn refining industry was found-

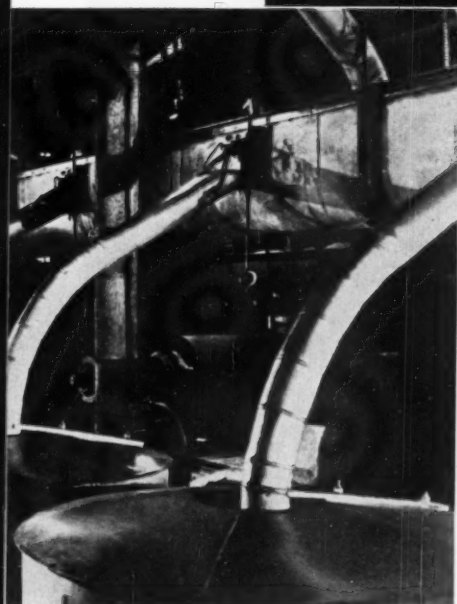
GLUTEN
STARCH
HULL

STARCH
AND
GLUTEN

GERM

CORN KERNEL

About 80 percent of the dry substance of the corn kernel is made up of starches or carbohydrates. Protein (contained in the gluten) accounts for 10 percent; and minerals or ash, approximately 2 percent. The photograph at the left shows a cross section of the remarkable corn seed with the major parts labeled.



PEARL STARCH

Moist starch cake is dried in long, continuous tunnels and is discharged in the form shown here. The powdery white stuff is known as pearl starch. It may be sold as such, can be further ground, pregelatinized, converted to dextrans or to derivatives of considerably different physical and chemical characteristics. By hydrolyzation, starch suspensions can be converted to syrups and sugars.

package. It comes ready-wrapped, in a tough fibrous hull known as bran. Just under the hull and blending gradually into the starch that makes up most of the kernel, is the protein part, or gluten. Buried deep inside is the germ, which is rich in vegetable oil. The composition of the dry substance of the corn kernel averages about 80-percent carbohydrates (starches), 10-percent protein, 4- to 5-percent oil, 3- to 4-percent fiber and about 2-percent mineral.

Starch, and the sugars and syrups made from it, are often considered to be the primary products of corn, any others being classified as by-products. Starch has been extracted from grains in varying ways almost since man began to keep records of his activities. Obtaining it from corn, however, is a relatively new step—the first United States patent for a suitable process was granted in 1841. In 1844, Colgate & Company built the first two corn refining plants in the U.S.—one in Jersey City, N.J., and the other in Columbus, Ohio. Today, according to the Corn Industries Research Foundation, the industry includes eleven companies operating fourteen plants, thirteen of which are located in the Corn Belt, and annually produces

about 5 billion pounds of corn starch more than 2.25 billion of which is marketed as starch. About 1.5 billion pounds are converted to corn syrups and 1 billion pounds go into the manufacture of corn sugars. From what remains of the corn kernels after starch extraction, 275 million pounds of corn oil is produced, along with 1,000,000 tons of livestock feeds.

Starch is an exceedingly complex substance. A granular material, chemists consider it to be a spherocrystal (literally, a spherical crystal) and molecules are laid down within its granules in concentric onion-like rings. Plants make starch by polymerizing dextrose units. Starch molecules may "grow" either as linear chains or as tree-like branched ones. Yellow dent corn, which is the most common variety used by refiners, contains about 27 percent of the linear-chain type, the remainder being branched.

The granular structure of starch may be explained in terms of the attractive forces between the large polymers. The linear molecules and the linear portions of the branched ones tend to intertwine into so-called micelles. In turn, a particular branched molecule may be part of

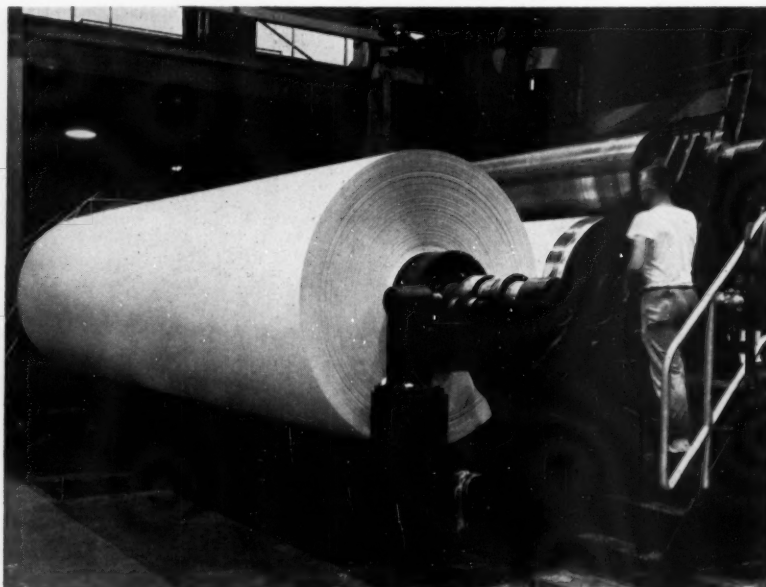
ed on the need for starch. Today, it is an important segment of the country's economy. Annually, corn refiners grind about 140 million bushels of the shelled grain. They pay about \$175 million to \$200 million for it, depending on going prices. For power, fuel, machinery, etc., the industry as a whole spends \$70 million each year, in addition to the almost \$40 million disbursed in wages and salaries, and \$50 million paid to railroads. Total value of the end products is from \$440-450 million.

The corn seed that is responsible for all these figures is a remarkable food



PHOTO, AMERICAN COTTON MANUFACTURERS INSTITUTE, INC.

Starch In Industry



IRON AND COTTON

Foundry core sand, one type of which is pictured at the top left being tamped into place by a pneumatic sand rammer, often contains a pregelatinized starch that helps the oils and special clays hold the sand in intricate shapes. The illustration above shows the "slashing" operation in a cotton yarn mill. Raw cotton is not sufficiently resistant to the abrasive back-and-forth action of the weaving shuttle, hence warp thread is sized with starch to give it the required stiffness and strength. The strands are dipped into a hot bath of the starch solution, squeezed between rollers to remove the excess compound and then dried on heated drums.



PAPER AND LEATHER

The use of a starch sizing to improve the surface quality of paper developed, for all practical purposes, with the half-tone engraving. The new art made it possible to achieve great detail in reproducing photographs on the printed page. Many coated papers, on which half-tone engravings register best, use some starch. Starches also have been utilized, almost since the beginning of the paper making industry, to add toughness, resistance to scuffing and tearing and so-called "rattle." In tanning and dressing leather, dextrans are used to hold hides to glass plates during a trip through driers. The "gluing" operation is shown in the picture below. Dextrin adhesives are also used in paper sizing, foundry core sands, and certain phases of textile finishing.



two or more of these micelles, or a linear one may be interwoven through several of the bundles. Thus the granule is given form and also a resistance to solubility in cold water. The granular structure is important to the property of starches that causes them to gelatinize.

Although starch is insoluble in cold water, a starch-water suspension will gel if heated above a critical temperature. Gelatinization proceeds over a range, rather than at a given point. Corn starch, for example, thickens in the range between 147-162°F. Heating a starch suspension, according to scientists, opens up the looser areas between micelles and the resultant absorption of water expands the granules and makes them elastic. This progressive swelling is responsible for the increased viscosity of the starch suspension. The micellar

networks are not completely broken by gelatinization. Linear starches are most resistant to gelatinization and breakdown; branched varieties, least resistant. By proper application of these characteristics, corn refiners thus are able to tailor-make a starch for almost any use.

About 6.5 percent of the industry's output goes directly to the household user as packaged starch for food and laundry. About the same amount is exported. The remainder is used in a variety of ways, a great many of them nonfood applications. The paper industry uses more corn starch than any other single nonfood user, approximately 400 million pounds* being consumed annually. The addition of starch to pulp adds

*Figures on utilization of starches by this and the following industries are estimates adapted from "Corn in Industry" (1952), the last year for which the publisher, The Corn Industries Research Foundation, Inc., has gathered this data.

strength to the finished paper. After paper is made, it may be surface-sized with starch to give it a smooth surface that will take ink well, or erase easily. Starch and dextrins made from starch are important ingredients of adhesives used for laminating and corrugating paper.

The textile industry uses an estimated 250 to 300 million pounds of starches each year, making it the second largest market for the corn refiner's main product. Cotton as well as some synthetic fibers are sized with it, thus imparting to them sufficient abrasion resistance and strength to withstand the weaving process. Starches also are extensively used in the finishing process to impart a certain feel or texture to the cloth. Commercial laundries utilize about 150 million pounds of starch per year.

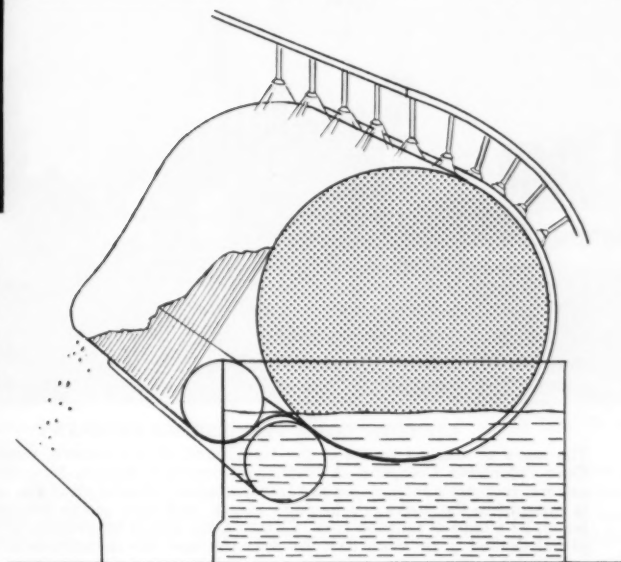
Almost 300 million pounds of starches are used in a variety of other nonfood applications. Oil-well-drilling mud contains it, as does foundry sand where it acts as a core binder. Both starches and dextrins are used as depressants in flotation processes by which wanted minerals are separated from their ores. Adhesives made from it are in charcoal and coal briquettes, as well as in asbestos board. It has an important role in plastics manufacture. It is used in match heads.

Food manufacturers buy about one third of the total starch production. The brewing industry, for example, uses about 150 million pounds of it annually. In the manufacture of baking powder, some 50 million pounds are consumed. Confectioners also use an estimated 50 million pounds directly, plus additional millions of pounds of corn sugar. Molds made from starch are used to form chocolates and bon-bons. Bakers and millers utilize some 25 million pounds of corn starch each year, either directly as an ingredient, or for dusting. Canners and



VACUUM FILTRATION

Giant vacuum filters (above) separate starch and water as well as wash the starch cake. As shown in the accompanying sketch, these filters are large drums rotating in a bath of so-called starch milk. The suspension is drawn through the bolting that covers the drum by drawing a vacuum on the inside of the drum. The starch particles build up on the cloth and as the drum revolves large quantities of water are sprayed onto the starch cake, washing it and further leaching out any solubles remaining in it. The washed cake is lifted from the drum by closely spaced strings and may then be dried to form pearl starch, or may be returned to a suspension for further processing.



←PHOTO, CORN INDUSTRIES RESEARCH FOUNDATION, INC.

food specialty makers utilize the remainder as thickeners and flavor carriers as well as binders for such meat products as sausage and frankfurters.

CORN SYRUPS AND SUGARS

Manufacture of sugar from starch is said to have started during the reign of Napoleon I. France was at war with England, and the efficient British Navy had blockaded Europe so well that little sugar could be imported. Napoleon offered a reward that was said to be about 100,000 francs for the successful production of sugar from some native plant. A Russian by the name of Kirchoff came up with an answer. He determined that if potato starch were hydrolyzed it yielded a thick syrup that tasted sweet. In essence, he broke down the high-polymer starch molecules into the component dextrose building blocks. The starch-sugar, as it was called, gained immediate acceptance in the brewing and distilling industries, but was used for little else. Then, in 1814 when the blockade of Europe was lifted and cane sugar became available, most of the starch-sugar establishments closed down.

The process was not used in the United States until 1842, and did not reach commercial importance until 1857. In 1866, a plant in Buffalo, N.Y., first utilized corn starch for the process—up to then, potato or wheat starch had been used. Starch hydrolyzates, today, are classified by their dextrose equivalent, or D.E. Corn syrups have a D.E. range of 30 to about 65. Pure dextrose, crystallized and refined from the syrups, of course, has a D.E. of 100. Other sugars

are made having D.E.'s of from 80 to 90. About 25 pounds of pure anhydrous dextrose can be obtained from a 56-pound bushel of corn. Syrups, because of the addition of water, give much larger yields, however; some 40 pounds of 20-percent moisture corn syrup can be made from a bushel.

Nearly 95 percent of the corn syrups and sugars go to the food industry. Corn syrup's major market is the candy industry, about 700 to 800 million pounds being used annually. Mixed syrup for home and restaurant is the second largest use. Corn refining companies mix and distribute 200 million pounds of this type of syrup annually, besides selling an estimated 80 to 100 million pounds of straight corn syrups to other companies for mixing. The baking industry utilizes some 100 million pounds and breweries, about 40 million. Certain types of corn syrups are used in paper and textile manufacture and in pharmaceuticals and tobaccos as well as dyes and inks.

More than half the total output of corn sugars (dextrose) is used in the baking industry—some 370 million pounds. Preserved foods such as jellies and jams as well as canned and frozen foods take up about 70 million pounds of corn sweetening and about an equal amount goes into the nation's "pop" or soda beverages. Candy and ice cream makers each use about 30 million pounds. Corn sugar can also be converted to alcohols for industrial uses, and one of these, sorbitol, is the raw material for the synthesis of vitamin C. Crude corn sugars are utilized in leather tanning and rayon manufacture.

LACTIC ACID

Lactic acid is one product of the fermentation of corn sugar, and has many uses in food products, tanning, textile printing and pharmaceutical manufacture.

CORN OIL

Corn oil, even though a by-product of corn refining, is an important part of the economy of the operation. About 2 pounds of oil is extracted from every bushel of corn processed and about 50 million pounds of crude oil, 170 million pounds of refined oils and 40 million pounds of soap stock are marketed each year. Not all of this comes from corn refiners, however; some is made available by dry millers and distillers. It is used primarily in the food industry and has a caloric content of about 4000 per pound. One of its most appetizing uses is in the preparation of french fried, or deep-fat-fried foods. In industry, corn oils are used in the making of soaps and insecticides.

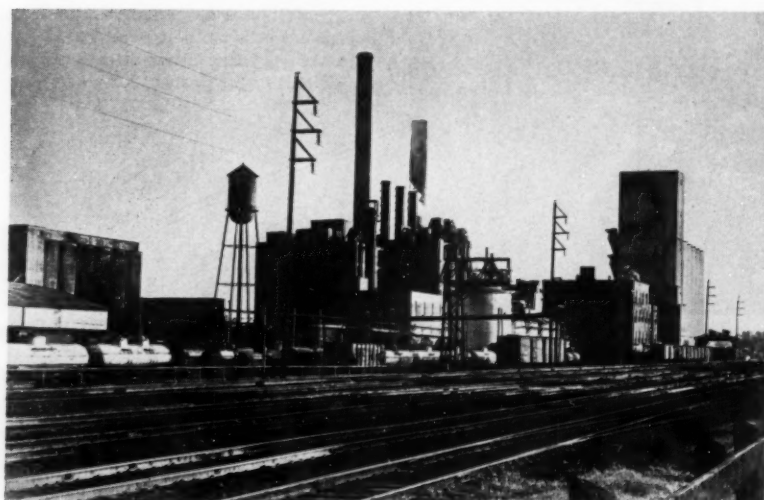
LIVESTOCK FEEDS

It was noted that almost 90 percent of the corn crop is fed to livestock. One of the most important by-products of the corn refineries is additional livestock feeds made up of the protein bearing parts of the corn kernel—the gluten—and the dried parts of the hull and germ. To this are added the residues of many other refining steps, including corn steepwater and sometimes hydrol, the liquid left after sugar crystallization. These feeds are graded by the percent of protein that they contain and are used for supplementing the regular diets of substantially all farm animals.

There are a number of other corn by-products, including zein, the pure corn protein, which can be made into a fabric, used as a base for lacquers, etc. In truth, there are about as many possibilities for products derived from corn as there are from petroleum. The operation of a modern corn processing plant can be closely compared to that of a petroleum refinery, the only exception being that the former starts out with, and must handle throughout the process, a number of solids or solids suspensions. In next month's issue we will describe the operations of Clinton Corn Processing Company, A Division of Standard Brands, Inc.

Located beside the Mississippi River at Clinton, Iowa, in the geographical center of the corn belt, the plant annually grinds more than 16 million bushels of corn. The facility occupies a 42-acre tract upon which are about 90 structures having a total floor area of more than 1,000,000 square feet. Compressors, pumps and steam-jet equipment play an important part in the refining of corn.

(To Be Continued)



CLINTON CORN PROCESSING COMPANY

The maze of railroad tracks in the foreground of this general view of Clinton Corn Processing Company, A Division of Standard Brands, Inc., illustrates the general industry's reliance on rail transportation. Almost all of the raw material is brought to the industry's fourteen plants, and most of the finished products leave, by means of railroad cars. Clinton Corn grinds an average of 33 carloads of the shelled grain each day, for example, and the industry as a whole, 140 million bushels per year.

ON THE counters of several thousand drug and hardware stores throughout the United States can be seen a small electric accessory not much larger than an electrical plug of the type inserted into a wall outlet. It is used to change a-c current to d-c, thus increasing the speed of small electrical motors. The story surrounding this useful gadget seems unbelievable, yet the facts have been authenticated and historically verified. It is the story of selenium, which in itself is a mystery.

About 75 years ago, a herdsman stopped on the plains of southern Wyoming to let his sheep graze on a patch of grass that grew thickly in the area. Several hours later, some of the animals began to walk rather unsteadily, and shortly, hundreds were dead or dying. News of the disaster spread rapidly, and others admitted having had similar experiences. The area soon became known as Poison Basin.

In 1917, the University of Wyoming sent a research chemist to learn the mystery of Poison Basin and determine the reason why the animals had died so quickly. Sixteen years later, he uncovered sufficient evidence to name selenium as the mystery killer. His analysis revealed that the plant, of the milk vetch variety, upon which the flocks fed, had the property of drawing selenium out of the soil and concentrating it in its leaves. Thus the sheep, chewing on the grass, absorbed lethal amounts of the element and quickly died. (Reportedly there is no antidote for selenium poisoning.) As a result of further investigation, it was determined that this particular plant only grew where there was selenium. Hence, wherever it is to be found, so there will be selenium in the soil.

For a number of years, this was of little interest to anyone but stockmen. Poison Basin acreage could be had for pennies. However, late in the 1940's, experiments proved the element to be a useful ingredient as a catalyst in the manufacturing of cortisone and in processing glass and alloying steel. It soon took its place on the market with a fairly stable price of about \$1.75 per pound. In the early 1950's, a few work-

Something About Selenium

able deposits were discovered. Later, the price rose to more than \$13 per pound. This figure is not that of the all-time high, for there is on record a black-market cost of \$40 per pound and, as a result of a copper strike in 1956, a price of \$80 per pound.

According to recent statistics, commercial-grade selenium was quoted at \$12 per pound and the high-purity variety at \$15, on January 1, 1957. Five months later, the price of the former was dropped to \$10.50, and the latter to \$13.50. By the end of last year, both

sodium nitrate and sand or oxidized with nitric acid. In the second two mentioned, it must be treated with hydrochloric acid and sulphur dioxide before it can be set free. Smaller quantities also appear in certain geologic formations, and it is hoped that development of these will increase the uses for selenium. Selenium is widely distributed, being the fortieth element in plentifulness and lying between bismuth and gold, but is never concentrated in a single area. It appears in the sandstones, shales, volcanic sediment and sulphides of Utah, Wyoming, Colorado, Kansas and the Dakotas, having been formed primarily during the Jurassic, Mississippian, Eocene, and Upper Cretaceous ages—many of the same formations in which uranium is mined.

For many years, the Colorado School of Mines has been working on a technique by which detection of selenium deposits can be more accurately made,

and its percentage tenor, more carefully estimated. To date, the most conclusive field test to check for selenium is to strike the suspected rock with a hammer. If the element is there, a pungent garlic-like odor will be apparent. It is curious, in one sense, that this method was devised after bulldozer operators reported smelling it during their work in open pit mines. It is not curious at all, from another point of view, because such questions as what selenium is, how it works and where it is found, make it one of the most mysterious of the elements.

J. J. Berzelius isolated selenium in 1817, naming it from the Greek *selenē*, meaning moon, be-

cause of the recently discovered tellurium; the latter derived its appellation from the Latin *tellus*, earth. Indeed, for many years it was called the moon element. Selenium is closely allied with sulphur, both physically and chemically. It has an atomic weight of 79.2 and its atomic number is 34. It has six isotopes with atomic weights ranging from 74 to 80.

Selenium finds use in the glass industry as a decolorizer. Its pink color counteracts the green tones derived from iron in the glass. However, when it is added in quantity, as either barium selenite



declined further to \$7.50 and \$10.50 per pound, respectively.

Nevertheless, selenium has remained in Group I of the Strategic and Critical Materials List, and the U. S. Government is ready to give financial assistance to exploration projects, paying 75 percent of the costs. This did not arouse as much interest as had been anticipated, and by the end of 1957, the outlook for selenium remained uncertain.

The greatest source for this element appears as a by-product in manufacturing, as for example, in the anode slime in copper refining or as fused with

(BaSeO₃) or sodium selenite (Na₂SeO₃), it turns the glass a deep red. Such material is used in warning lights on railroads, beacons and the like. Commercial-grade selenium is added to wrought stainless steel to make it stronger and more corrosion resistant and machinable. It is added to stainless castings to reduce gas content. Copper becomes a free-cutting metal with about 0.5-percent selenium added, and its electrical conductivity is nearly equal to that of pure copper. Its tensile strength, when annealed, is 30,000 pounds per square inch. Small amounts of selenium salts added to lubricants prevent oxidation and gumming. Some have used the substance for fireproofing cables, and diethyl selenide is used as a warning odor for such poisonous commercial gases as carbon monoxide. The rubber industry makes extensive use of it as an accelerator during vulcanization, increasing the tensile strength and abrasion resistance of the rubber.

Of all the applications, however, by far the most are based on selenium's curious property of changing a-c current to d-c. Why it does this is unknown. What causes it is light energy. Apparently there is little or no color selectivity. Selenium reacts not only to sunlight, but also to ultra-violet, X-, gamma and radium rays as well.

This light sensitivity was first discovered by Willoughby Smith in 1873 while he was performing some experiments in submarine telegraphy that required a substance of high electrical resistance. Siemens suggested its use in photometry in 1875, and since then, there has been a steady stream of applications. Ayrton and Perry described their "electrical vision" in 1880, and the following year Shelford Bidwell constructed several improved selenium cells. Professor Minchin used the material for measuring light from the stars in 1891, and Korn began work on electrical transmission of pictures in 1902—the first successful one being sent from Munich to Berlin in 1907. E. E. Fournier d'Albe devised the optophone that

enables the blind to read ordinary type by ear, in 1914, and shortly thereafter, the photographophone came into being. The last mentioned is the means by which motion pictures talk. One edge of the film runs between a light source and a selenium cell. Changes in photograph density are enough to make changes in the current passed through the bridge. When these variations are transmitted to a loudspeaker, speech is reproduced.

All of these devices are based on the selenium cell. In its simplest form, it is made of two copper wires, side by side, 1 millimeter apart. These are placed on a strip of mica which is placed over a hot plate. A thin layer of high-purity selenium is then melted over the wires, cooled and reheated. (Almost the entire high-purity product is devoted to the manufacture of selenium cells and rectifiers.) The black-looking lustrous selenium becomes a dull grey substance, and it is in this state that it is sensitive to light and a fair conductor of electricity. With the two adjacent ends of the wires separated and a potential difference of 50 v applied to the others, a current of perhaps 50 to 100 microamperes may be passed in the dark. In daylight, this may rise to 300 microamperes and more.

Selenium melts at 428°F, and when cooled, remains amorphous. On reheating to 356°F, it changes to one of two grey varieties that are nothing more than a mass of light-sensitive crystals, the shape being influenced by the temperature at which they were formed. This appears to be the only factor in the reaction speed and capacities of the cell.

The sensitivity of a selenium bridge is expressed by stating the ratio of dark current to that which is passed under 100-foot-candle illumination. Well-constructed cells may have a ratio of 1 to 100. When the light source is removed, it takes, ideally, 1 second to return to within 5 percent of the cell's original value. This time lag is called inertia.

Because of the comparatively large

amount of current that is carried by a selenium plate, and because of the simplicity of the accessory apparatus, the substance and cells made of it are useful as relays that stop and start other actions. This is not only the basis of the various inventions mentioned previously, but of devices for activating sunshine, fog, moonlight and eclipse recorders; street lamps; fire alarms; and the like. It has even been used in more accurately checking the results of horse races.

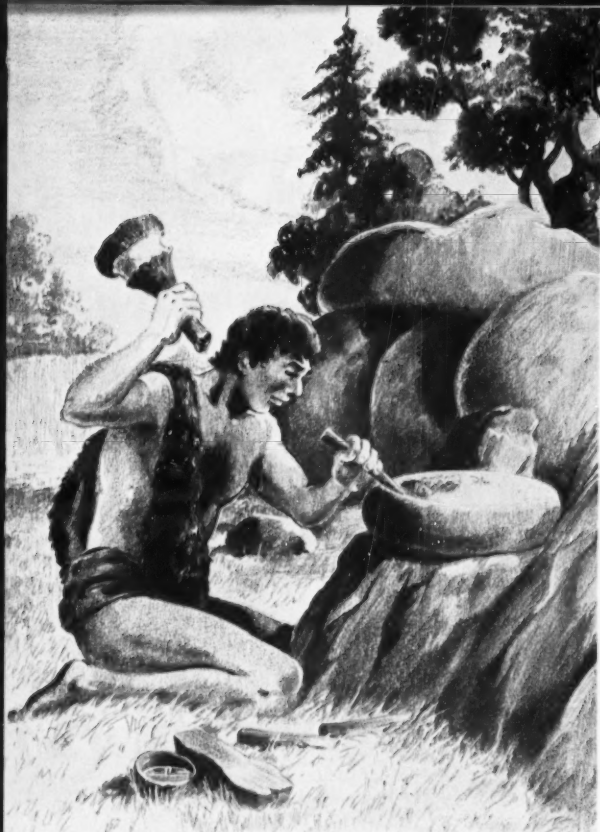
With such a variety of applications, it would seem that selenium production would be wide spread. In keeping with its other strange aspects though, it is not. There are only five companies in the United States that produce approximately all of the primary and secondary selenium, namely American Metal Company, Ltd., American Smelting & Refining Company, International Smelting & Refining Company, Kawecki Chemical Company and Kennecott Copper Corporation. Their shipments to consumers dropped from an average 86,000 pounds per month in 1956 to 50,000 in 1957, while at the same time, producer stocks increased sharply from 191,000 pounds in January of last year, to 588,000 pounds on October 1. Imports subsequently decreased, although Canada remained the major source. (Lesser suppliers are Japan, West Germany and Sweden.) Exports at the beginning of 1957 were restricted to a 6000-pound-per-quarter quota. During the year, it was gradually increased until during the last half it was on an open-end basis. In all, production in 1957 totaled an estimated 1.1 million pounds, as compared to a record 1,117,000 pounds the preceding year.

Even though substitutes are making significant advances in the rectifier industry and the technical advantages and advances made with silicon and germanium indicate a lessening of selenium's importance, reports indicate that this year will see little change of its use in the metallurgical, chemical, ceramic and pigment industries.

ABOUT "THE CONQUEST OF ROCK"

Reproduced on the following four pages are twelve sketches depicting the advance of rock-drilling techniques through the ages. They make up the major part of a collection commissioned by Canadian Ingersoll-Rand Company. The originals were rendered in pencil by Capt. L. R. Batchelor. Reprints of this panorama of drill history are being prepared. Readers desiring copies may obtain them by addressing requests to Reprint Service, "Compressed Air Magazine," 942 Memorial Parkway, Phillipsburg, N.J.





ABOVE: Cave man forming a rock bowl.

RIGHT: Single jacking, still used in some remote parts of the world.

BELOW: Double jacking. It is said that some teams outran early piston drills.



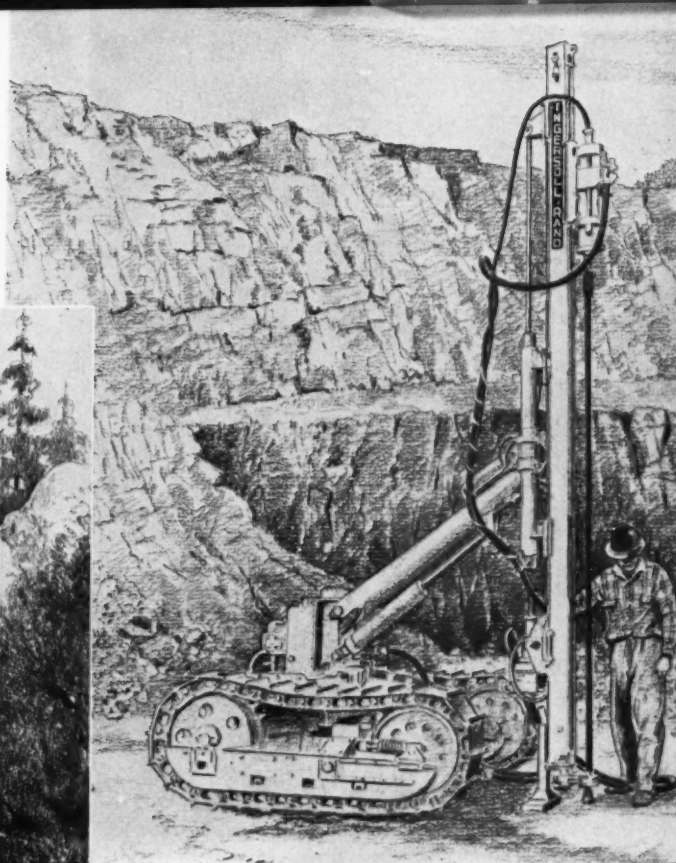
The Conquest Of Rock

PANORAMA OF ROCK DRILLING

THIS 4-page group presents a panorama of rock drilling scenes from man's first efforts with wooden mallets and bronze chisels, to modern air-powered equipment that punches out holes at speeds once believed impossible. These sketches were made by Capt. L. R. Batchelor, a military artist with a wide background in mining. His work is authentic even to the clothes worn by the drillers.



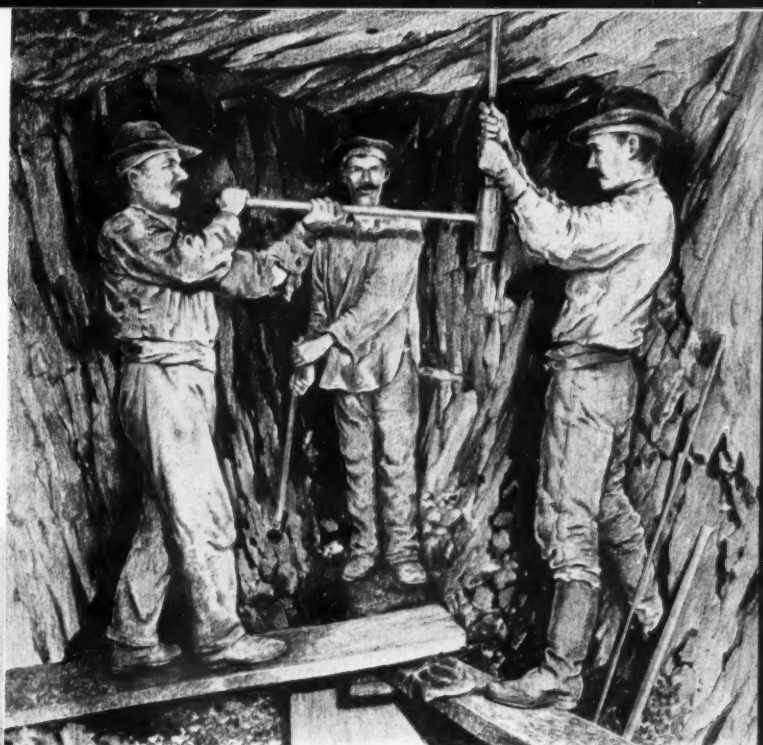
BELOW: Today's modern Jackhammer. First models were developed in 1912.



ABOVE: The "Little Giant" piston drill. This machine opened up a continent and was the peak in small piston-drill development.

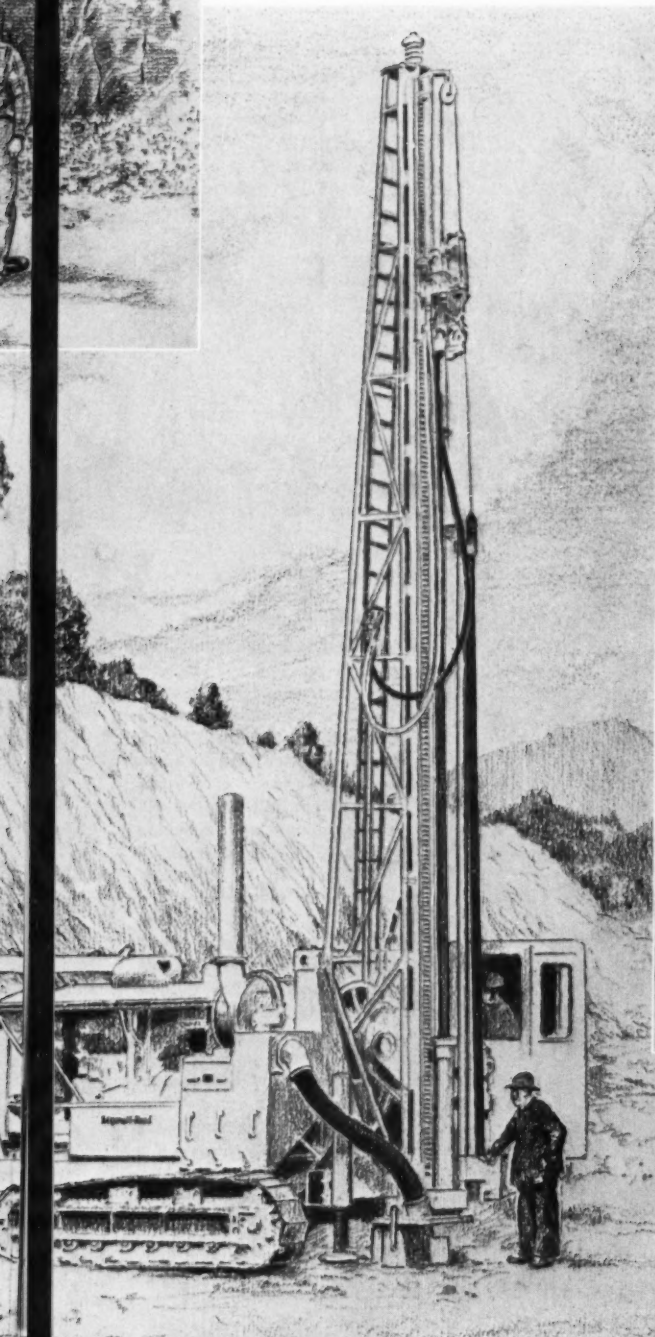
LEFT: The modern Crawl-IR. It is tracked, self-powered, highly maneuverable and a recent development in drilling.

BELOW: The Drillmaster. A complete, packaged drilling system used for large diameter, primary-blast-hole work.



TOP: Drilling an "upper" with double jacks and hand-held steel. It required great endurance.

ABOVE: Stopehammers, air-fed and now dustless, they make stoping no more difficult than other forms of drilling.



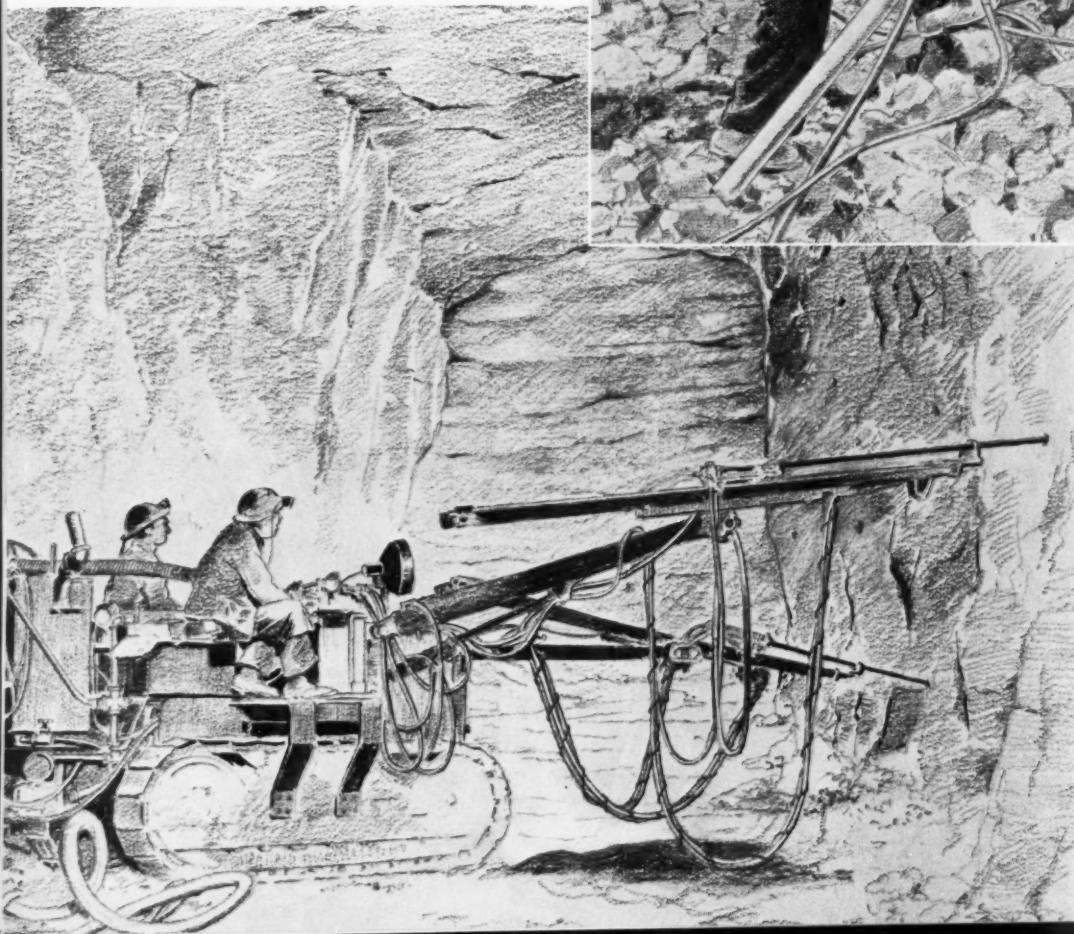


LEFT: Once the only method of drifting, many of today's mines originally were prospected by similar hand drilling.

BELOW: Jackleg. Air-fed, light and easy to use, it has replaced small column-bar drills.



BELOW: Drifting with Hydra-Booms. Late development replaces heavy drifters on bar mounts.



HOW IT IS BUILT

Cross-sectional view of the proposed bubble chamber under joint development by the National Bureau of Standards' Cryogenic Engineering Laboratory at Boulder, Colo., and the University of California Radiation Laboratory at Berkeley, Calif. The chamber and observation window, housed within a vacuum, are indicated in the central portion of the drawing. The vessel is to be filled with liquid hydrogen. The magnet coils of the particle accelerator surround the apparatus and the particle beam enters the chamber from the left, where a man's outline is shown for size reference. Cameras at the top will record the bubble paths for later study. The chamber is scheduled for completion by the fall of 1958.

Bubble Chamber For A Bevatron

MANY of the achievements that man has produced in his so-newly-fashioned nuclear age have been made possible by improvements in particle accelerators and accompanying advances in atomic particle detection. One of these detection devices, a bubble chamber being built to operate with a 6,000,000,000-v Bevatron at University of California Radiation Laboratory, Berkeley, Calif., promises to add still further to the knowledge of high-energy nuclear physics.

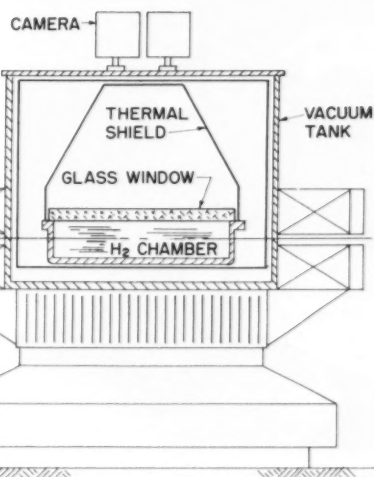
The vessel under construction will be 60 times the size of any now in use. Physicists are awaiting its completion, which is scheduled for autumn of 1958, with hopes that the device will help answer some of the knotty questions of fundamental nuclear physics. Working with UCRL in development of the bubble chamber are scientists of the National Bureau of Standards' Cryogenic Engineering Laboratory at Boulder, Colo. Their work is primarily concerned with the many problems of extreme temperatures involved in operating such an apparatus.

A bubble chamber is a vessel filled with a transparent liquid that is superheated to a very high temperature. When a high-speed ionizing particle is passed through the fluid, violent boiling results, and the particle leaves a telltale wake of tiny bubbles. These are photographed a short time later, while they are still small, and the bubble configurations in the pictures often reveal valuable scientific information about the particles.

This chamber will have an approximate capacity of 550 liters and will be filled with pure liquid hydrogen. This makes an excellent "target material," as it is called, because hydrogen has a high nuclear density at low pressures. It also has a simple, lightweight nucleus, that provides elementary particle interactions and avoids confusion that might arise when a high-energy particle strikes a heavier nucleus. The bubble chamber is a newcomer to the particle-detection field and was developed to overcome shortcomings of cloud chambers, photographic emulsions and other similar

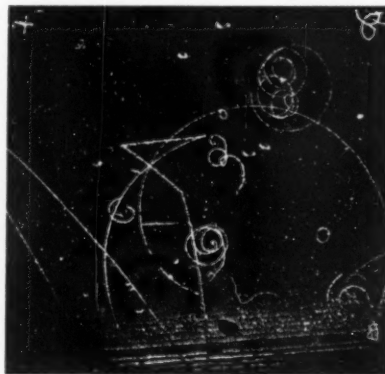
equipment. The cloud chamber, in some respects, is not unlike the bubble chamber. In the former, drops of water are made to condense on the ions produced by particles in rapid passage. The trail of droplets is dense enough to be visible as a white line. As is done in the bubble chamber, the path is photographed for subsequent study.

Successful operation of 1/2- and 8-liter liquid hydrogen bubble chambers, built during the past 2 years by UCRL, led to the idea of building the new vessel. Operation of this large a chamber will be far from simple. Hydrogen in a liquid state, at normal atmospheric pressure, boils at 20°K (-424°F). Its critical temperature is 33°K (-400°F) above which no liquid phase is possible, and its critical pressure is thirteen atmospheres. Consequently, keeping the fluid



PATTERNS

The photograph reproduced here was made as high-speed ionizing particles were passed through a hydrogen bubble chamber at the University of California Radiation Laboratory. Paths left by particles introduced into such chambers often reveal phenomena and characteristics that allow scientists to learn more about fundamental nuclear physics.

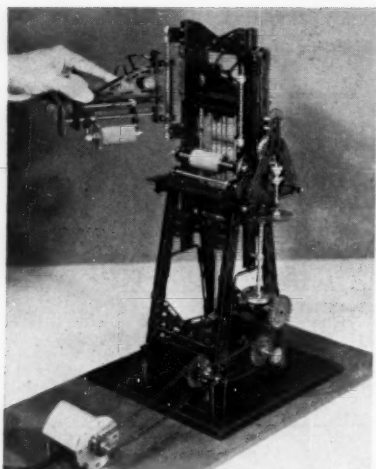


at about 27°K (-411°F) and six atmospheres has been found to be successful for bubble chamber purposes. However, to make the chamber sensitive to particles passing through it, the liquid must be superheated. This is done by suddenly reducing the pressure from six, to two or three atmospheres. After the particle-streak photographs are taken, the liquid is compressed and returned to its original, sub-cooled state.

Refrigeration is necessary to keep the liquid at a constant temperature because the irreversible superheating process adds energy to the liquid. This chamber will utilize the Joule-Thomson process of gas-expansion refrigeration operating at 2000-psig pressure. Two-hundred cfm of hydrogen gas will be circulated in the device to provide the necessary cooling. When not needed as a refrigerator, the unit will be operated as a liquefier to produce 60 liters per hour of liquid hydrogen.

The chamber size will be 15x20x84 inches. Of special interest is its 20x72-inch observation window. It will be 5 inches thick to withstand the 6-atmosphere pressure, and optical properties will have to be good to prevent visual distortion. An extensive investigation of low-pressure mechanical properties of glass, conducted by Cryogenic Engineering Laboratory scientists, was necessary. Whenever possible, warming of the glass and the bubble chamber will be avoided, because of the necessary cooling time to prevent breaking the window. It is estimated that about 7 days will be needed to warm the chamber to ambient temperature and cool it again to the operating temperature of about 27°K.

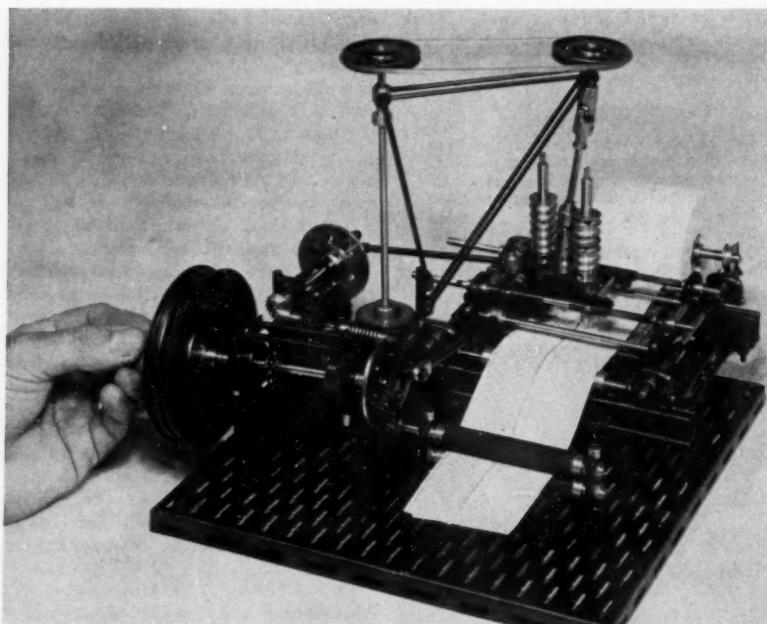
D. B. Chelton, D. B. Mann and B. W. Birmingham are the Cryogenic Engineering Laboratory scientists working on the development. R. H. Kropschot and R. P. Mikesell carried out the low-temperature glass research.



LOG SAW

Demonstrating how working models reveal load distribution, this log saw works with the same precision as its larger counterpart will.

MARK Sylwan, a Swedish inventor of exceptional European skill, has turned an ever-popular toy into a design aid of more than passing interest. Realizing the need of industry for an accurate method by which proposed machines and mechanisms, whose principles have not been thoroughly substantiated, could be built and proved without vast development-program expenditures for equipment, he has devised a means by which engineers and designers can create working miniatures.



BALL-POINT-PEN TESTER

As with miniature traveling cranes, rail cars, presses and the like, this tester shows the precision of the FAC System.

WHEN IS A TOY NOT A TOY?

The FAC System, as it is called, deriving its name from the Latin verb to *make* or *do*, has been likened to a foreign language. In the introduction to his first manual, the inventor says that the illustrations of the models, "which are shown in varying degrees of completion, should . . . be considered as working examples, roughly analogous with exercises in a foreign language with a grammar and syntax of its own. Providing one has learned how to command it, there is nothing one cannot express with it." Frameworks are assembled logically from basic forms. Starting with round rods and beams that are connected with sturdy fasteners; ball bearings; spur, bevel, internal and worm gears; gear racks; ratchets; sprockets; pulleys; sheaves; couplings; springs; wheels; disks; and universal joints are added until the project is complete.

Construction follows the laws of reason. Since only basic mechanical forms from the "universal storehouse of technology" are used, there are unlimited numbers of alternative solutions for any one problem. Thus, FAC gives rise to a purely intellectual stimulus, reminiscent of chess. "As with chess, so with FAC, it is a question of finding the most satisfying solution with few, but correct, moves."

Frameworks support all moving parts and can be varied within wide limits,

from airy, graceful mast constructions to compact girder and plate designs. From them, it is possible to erect smooth-operating, precision-detailed transmissions, differentials, coil-spring devices and the like. From these relatively simple models, it is easy to demonstrate and test load distribution and moving-part arrangements.

The kits are available in two sizes. The smaller contains 2700 parts and is intended for student and professional engineers. The larger has a selection of 4700 parts especially selected to meet industrial machine design and development requirements. The parts included in each are based on frequency calculations—that is, the quantities of the various pieces are in proportions characteristic of the majority of FAC constructions. Each complete set comes in a partitioned hardwood box.

All the constructions are purely mechanical in form, eliminating driver's boxes, bodywork and the like. Because of their precision, however, it requires a strong-willed man to resist finishing the foundations with such other media as wood, thin sheet-metal and plastic. Thus, the model-maker can put a very "personal signature to the completed work."

Since the first set appeared in 1952, many have been sold in Sweden and England, and as a result of their utility and popularity, are now available in America.

In addition to permitting the development of new ideas and mechanisms for design work, models made with FAC can be used as demonstrators to sell mechanical concepts. Their sturdiness, precision and long-service life make them ideal as test equipment for research and development. (One facility, for example, made the ball-point-pen tester illustrated on this page.) Because of their sizes, they can be used as actual stirrers and aids to laboratory experiments.

Sylwan, understanding man's desire to tinker, realized still another market for his system—children. He believes that by giving them precision-made systems such as this, they will "learn the language," and possibly develop an interest in the various technical fields. Consequently, he has put together special toy kits and has written a manual illustrating a wide variety of models that can be built with their furnished parts. Once acquainted with these smaller sets, the model-maker should have no difficulty in mastering either of the adult kits. The manuals that accompany the professional FAC Systems thence become a natural sequel, and the toy is no longer a toy.



LARGEST nonatomic blast on record, the recent firing of 1375 tons of Nitramex 2H explosive in a series of coyote drifts in the twin peaks of Ripple Rock shoals marked the end of a long series of engineering attempts to remove the craggy subaqueous rock. Official figures for the size of the A-bomb-like mushroom that blossomed forth with the blast indicate that spoil and water were hurled 1000 feet into the air in a column 800 feet thick and from 50 to 200 feet wide.

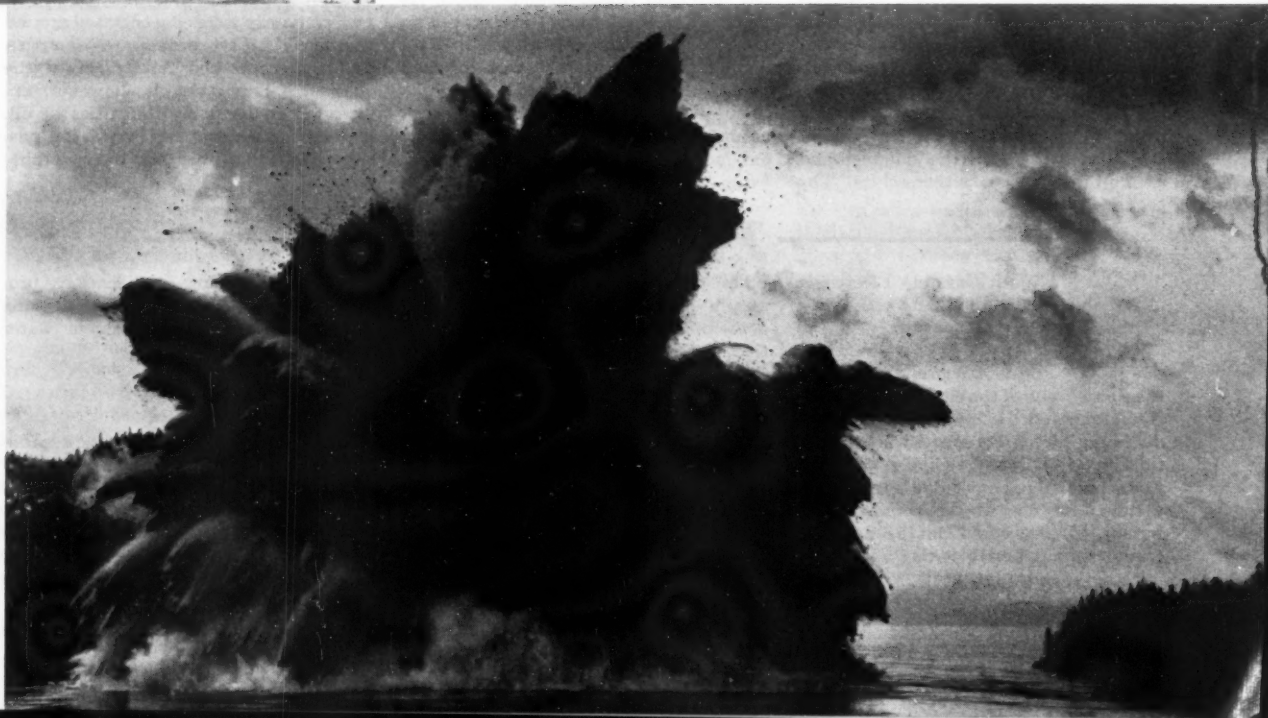
The explosion was the climax of a 3-year, \$4,000,000 job, the details of which were described in COMPRESSED AIR MAGAZINE, September 1957. Planned to shear off the jutting rocks to a minimum depth of 40 feet, the blast, soundings have indicated, removed at least 47 feet. The hefty explosion, despite fears of some, did no other damage to the surrounding area. An 8-foot-high tidal wave was formed, but spent itself harmlessly on surrounding beaches. Insurance underwriters who carefully photographed all structures within a reasonable dis-

tance prior to the blast, reported no damage and also indicated that the highest tremor shown on their seven seismographs was but 0.0013-inch. (According to reports, 0.0180-inch shocks are required to crack plaster.) In Campbell River, some 10 miles from the scene of the blast, 3000 residents of the town shut off all power and gas to their homes, stacked dishes on the floors and removed pictures and mirrors from the walls, besides opening doors and windows in anticipation of the shock. The blast produced no more than a mere shudder in the village, and some of the residents were not even aware that it had been fired.

The treachery of Ripple Rock was based on the changing tides that twice daily boiled through Seymour Narrows. The rapidly moving water was fashioned into giant whirlpools, 40 feet in diameter, by the shoals. These could suck down small craft and divert even the largest vessels from their course. To avoid the hazard, ships waited for slack tides and then, from both ends, streamed through

Gigantic Explosion Marks—

THE END OF RIPPLE ROCK





DRILLING AND BLASTING TECHNIQUES

Tri-purpose Ingersoll-Rand JR-38 Universal Jackdrills were used for all drilling at Ripple Rock. Hand-held, they sunk the 550-foot access shaft on Maud Island. Equipped with airlegs, they were then utilized in driving the tunnels and coyote drifts, and were also used in stoping access raises into the peaks. Three of the units are shown at the left working in the 6x7-foot access bore. Powder (Canadian DuPont Nitramex 2H) in cans was brought to the shaft on pallets of 72 cans each. These were taken intact into the bore. Mine cars, four to a train, transported the pallets to the access stopes where each load was divided and put into dollies, each carrying 36 cans. The powder was then hoisted to the coyote level with Ingersoll-Rand 25-hp tugger hoists. Then the dollies were conveyed to the unloading

points by skate-wheel conveyors. The load in each coyote hole varied, depending on the amount of overburden that was calculated for each 20-foot section. Two lines of special Primacord were laid along each coyote hole and were attached to special primers at 20-foot intervals (picture at the right). A total of 280 primers was utilized. No stemming was used in the holes, although some sand-bagging and sand backfill were used to fill the access stopes. The main detonating lines converged to four in the drift and were brought to the surface at Maud Island. Cable then ran from the shaft to the detonating bunkers on Quardra Island where the blast was detonated. A Du Pont CD-48-1 blasting machine supplying 480-v d-c was used. Dr. Victor Dolmage, consultant, fired the blast.

in a steady procession that in itself was fraught with danger, particularly at times of poor visibility.

The first attempt to do something about the shoals at Ripple Rock began in 1942. A drill boat, equipped with 125-ton anchors attached at each corner and in the center, was positioned over the peaks. A whole summer's work proved ineffective because no way could be found to keep the barge steady while even one hole was bottomed. A second drill-barge attempt, in 1945, utilizing shore-anchored still cables, also failed and for the same reason. In 1953, a study was authorized calling for an exploratory diamond drill hole to be sunk from Maud Island, on the east side of the Narrows, under the channel and then up into the peaks themselves. The

tunnels to Ripple Rock followed this drill hole to a certain extent.

The actual excavation required the expenditure of \$2,639,878, and a contract for that price was awarded a joint venture of Northern Construction Company, J. W. Stewart Limited and Boyles Brothers Drilling Company. The latter firm also held the exploratory diamond drill contract.

A 550-foot, 3-compartment shaft was put down on Maud Island. From its base, a 2370-foot tunnel was driven to the base of the Ripple Rock peaks. Two main access raises, 7x15 feet in cross section were then driven into the peaks themselves. Radiating into the rock around the raises, the contractor drove 6x7-foot drifts to serve as sublevels. From these, smaller (6x6-foot) bores

were raised at an angle of 45 degrees. Finally, from these raises, the coyote tunnels were excavated and loaded with the explosive.

Although Ripple Rock's fangs have been pulled, putting an end to a long history of marine tragedies (114 vessels are said to have been wrecked with the loss of more than 100 lives), Seymour Narrows will still present some difficulty to small vessels. This is because the swiftest waters and the eddies and whirlpools formerly were concentrated around the shoals. Fast water now is almost uniform across the full width of the channel. Large vessels, however, are expected to have no difficulties at all, and the dangers attendant to the passage of smaller ships are considerably lessened.

This and That

Balloon Seals Pipe

South Carolina Electric & Gas Company's Hagood Station uses sea water to cool its condensers. To provide a positive head on the suction side of the circulating pumps, the intake and the lower portion of the discharge piping are located below low-tide level. Discharge piping modifications involving about 5 day's work were planned for one of the cooling water pumps. These could not be normally made without first blocking and draining the underwater ports, a job that

takes several days and would have meant shutting down two other condensers at the same time. The alternative was to seal off the 30-inch pump discharge line in some way. The company's engineers thought that an inflatable plug might do the trick. They had a rubber company make up a 5-foot-long, 30-inch-diameter balloon of neoprene. The discharge piping was opened above the water level, the balloon was lowered into position and then inflated, and the seal tested for a complete tide-change. After proving satis-

factory, the piping modifications proceeded "in the dry," the balloon being deflated and withdrawn above water level afterwards.

★ ★ ★

Platinum Reigniter For Jets

Engine flameout, a problem encountered by jet aircraft, may be eliminated by a simple automatic reigniter tube that is smaller than an ordinary cigarette. The tube has no electrical connections or moving

parts. It is made of a platinum-rhodium alloy that has high heat retentivity and acts as a catalyst for fuel combustion. The high temperature is maintained by the heat of the jet engine's combustion chamber. Following flameout, the catalytic action and retained heat of the re-igniter enable it to restart the engine automatically.

★ ★ ★

Fishing With Electricity

A generator, designed by Conrad Kreutzer, a German physicist, is being used for fishing on the west coast of Sweden. Fish, such as cod, tend to swim towards the positively charged pole in an electric field. Thus, they can be directed towards a chosen point where they are numbed by the current and float to the surface. Catching them in a hoop net or by a suction apparatus of special design is a simple matter. The voltage for this type of angling is regulated so that the potential drop between the head and the tail of the fish corresponds exactly to the size of fish desired. Consequently, the smaller ones are left to mature. In the case of tuna, fishing is usually done by angling and requires special skill. To use the electricity method, it is proposed that the hook be made into the electric conductor. A series of d-c shocks of 400 v and 100 amperes would numb the fish sufficiently so that they could be towed, taken on board the vessel and clubbed without difficulty.

★ ★ ★

Coming Down To Earth

Experiments are being made by aviation experts with an improved system for parachuting a man back to earth from extreme altitudes without exposing him to hazards. The device, that consists of a closed capsule and a system of parachutes, is designed to be ejected from high-flying supersonic aircraft. The pilot simply presses an ejection handle. A complicated series of mechanisms then locks his shoulder harness into place and closes a sliding door to seal his container. This maintains the air pressure. Then, two explosive charges blow the capsule down a set of rails and out the bottom of the airplane. Machinery is set in motion to extend fins from the unit to steady it during its fall. Finally, the series of parachutes is released. Together with shock-absorbing equipment, they gradually slow the descent. Several types of capsules are under consideration, including those that consist of the entire pressurized cockpit, the whole front end of the airplane, a minimum-sized seat capsule and a compromise version that houses pilot, seat and

some control instruments. One of many engineering problems involved is that of providing enough structural strength to prevent the device from being torn apart during sudden stops or sudden spurts of acceleration. At high speeds, a pilot and his equipment may be subjected to forces many times that of gravity. Simply pulling out of a dive, for example, often subjects a pilot to nearly 10 g's. Although the specific capsule under examination is for the pilot who wishes to bail out while traveling faster than the speed of sound and many miles over the earth, it may, one day, be standard equipment for the space traveler who is within "jumping distance."

★ ★ ★

Steam Adds Life To Tools

Treatment of tool-steel cutting instruments with high-temperature steam adds to their life, it is reported, with some cutting edges lasting 50- to 100-percent longer. Sometimes, when tough materials are being machined, the treated tools reportedly serve as much as 600-percent longer. A typical treating cycle consists of preheating a so-called Steam-Homo furnace to 700°F, putting the tools to be treated into it and then purging the air from the system with steam for 30 minutes. Following that, the furnace is brought to a temperature of 1025°F and held there for 30 minutes, with steam still flowing. Then the tools are air-cooled and oil-dipped. This treatment produces a hard, porous oxide film that is about 0.0001-inch thick. It adheres tightly, retains cutting oil in its pores and has a high degree of corrosion resistance. Because of the retained lubricant, the tools don't heat up as fast and thus retain cutting edges longer. The oxide film also prevents chips of the work stock from being welded to the tools. Some metallurgists also believe that the treatment, performed after the tools are ground, relieves some of the internal strains set up by the grinding operation.

★ ★ ★

Protecting Steel From Corrosion

The U. S. National Bureau of Standards has completed a study of the electric potential needed to protect steel cathodically from corrosion in salt water. Data obtained under controlled laboratory conditions are expected to provide a basis for handling similar problems encountered under marine conditions. Normal corrosion of iron and steel is an electrochemical phenomenon. When metal is exposed to salt water, differences in electric potential develop at the surface of the metal, resulting in the formation of numerous

small corrosion cells. This action causes destructive alteration of areas, known as anodes, on the metal surface where metallic ions enter the electrolyte. In applying cathodic protection, direct current from an external source is caused to flow from an auxiliary anode toward the corroding surface. This prevents positive metal ions from entering the electrolyte. The potential at which a metal structure should be maintained in order to prevent corrosion is a question of practical interest. Insufficient negative potential will give inadequate protection. On the other hand, maintaining a greater potential than is needed is unnecessarily costly. The experiments were carried out with Washington, D. C., tap water to which was added 3 percent by weight of sodium chloride. Under both stagnant and aerated exposure conditions, results indicated that the best degree of cathodic protection was attained at minus 0.77 v with reference to a saturated calomel electrode.

★ ★ ★

Turtle Harvest Time

Spring in Venezuela means it's turtle migration time. Thousands of the giant reptiles move to the shores of the Orinoco River at this time of the year to lay their eggs. How they know when and where to go—some of the creatures have to swim hundreds of miles upstream to the nesting sites—is another of Nature's puzzling mysteries. Catching them has become a business and is under control of Venezuela's Ministry of Agriculture and Livestock. Because newborn turtles are easy prey to predators, armed guards keep watch over the nesting grounds. Once it appears that sufficient nesting has been completed, government officials indicate the catch may be taken. To capture them, one merely has to flip the reptiles onto their backs by hand, thus leaving them helpless. The taking begins at about midnight and continues only until the sun's rays first touch the river sand. The tortoises, a fresh-water type that lives alone but breeds en masse, have to return to water as soon as the sun is up because they can't stand the heat. Turtles harvested are shipped down the Orinoco to Ciudad Bolivar, are worth about \$2.40 and frequently become ingredients for the world's turtle soups and steaks.

★ ★ ★

Achievement In Chemical Metallurgy

Research scientists and engineers of The International Nickel Company of Canada, Limited, after 7 years of continuous study, have developed a process for electrorefining nickel. It features the direct electrolysis of nickel matte,

an artificial sulphide, as contrasted with the usual methods in which a metal anode is used. The process eliminates high-temperature oxidation and reduction operations, with attendant losses of metals and sulphur and selenium. Further, the process permits, for the first time in nickel refining, the commercial recovery of elemental sulphur and selenium as valuable by-products, in addition to cobalt and precious metals conventionally recovered. The separation is accomplished in a 100-foot-high fractionating column of special design. Inco recovers fourteen elements from this ore—nickel, copper, cobalt, platinum, palladium, rhodium, ruthenium, iridium, gold, silver, iron, tellurium, selenium and sulphur. At present, sulphur is being recovered in the form of liquid sulphur dioxide and sulphuric acid from the company's reduction works at Copper Cliff, Ont., and selenium is recovered in the refining of copper. The new process is in commercial operation at the firm's Port Colborne, Ont., facility.

★ ★ ★

Atom Pictures Taken With Ion 'Scope

An ion microscope has been developed which makes possible, for the first time, the photographing of atoms in a metal crystal. The invention culminates 19 years of effort by Dr. Erwin M. Mueller, a research professor of physics at Pennsylvania State University, University Park, Pa. The new microscope

doesn't look like a conventional optical one, but has more the appearance of two thermos bottles, one inside the other. It is built entirely of glass, is evacuated and contains a fine tungsten wire within that is cooled by liquid hydrogen to a temperature of minus 423°F. Up to 30,000 v of electricity are used in bouncing helium atoms off the tip of the tungsten wire. Positive ions are reflected from the encounter and show up on fluorescent screens, similar to television tubes. These screens reveal an apparent magnification of up to 5,000,000 power. The wire's tip is said to be about 1000 times smaller than the point of a sharp pin and, ironically, can't be seen through an ordinary optical microscope.

★ ★ ★

Strange Culinary Exercise

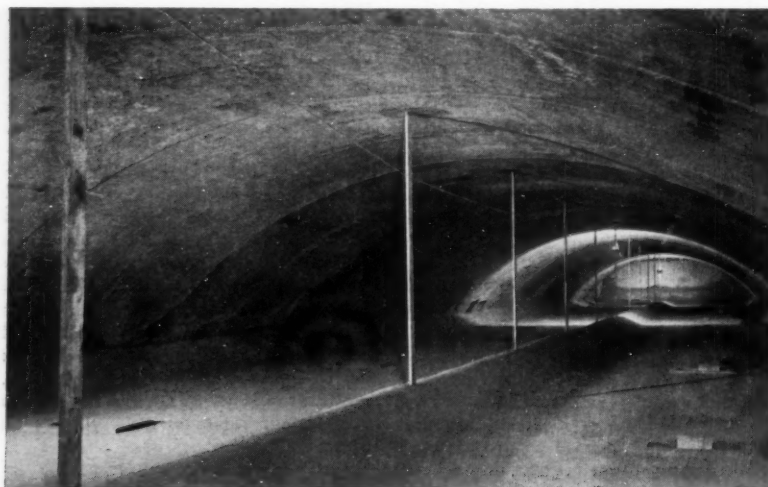
A few drops of synthetic sea water, a pinch of rare earths, a dash of oil-soluble compounds of magnesium naphthenate, mixed in a Waring Blender with a generous quantity of low-grade petroleum and then poured into a special "oven" and set afire, is a means of protecting high-temperature gas turbine engines from corrosion. Machines that operate by burning fuel such as petroleum, use the resulting hot gases to spin fan-like wheels. They are most efficient at high temperatures and speeds. In a quest for greater efficiency, however, engineers found that even if the turbine parts are made from the toughest metals and alloys, the blades and other exposed

components are corroded by the stream of hot combustion products. This is especially true when a low-grade fuel is used. To solve the problem, engineers at Gulf Research & Development Company, Harmerville, Pa., conducted a series of 125 laboratory tests in which they added various substances to the petroleum and measured the decrease in corrosion. The results showed that many substances, such as micronized talc, magnesium oxide and potassium permanganate, effectively reduce corrosion at costs ranging from less than 1 cent to about 11 cents per barrel of oil. It was further found that synthetic sea water and other materials containing sodium or potassium also reduced certain types of corrosion and enhanced the effectiveness of other corrosion-inhibiting additives. (The "sea water" was composed of carefully measured amounts of salt, magnesium chloride, sodium sulphate and other chemicals mixed with water. It was used instead of real sea water to guarantee that all tests would be carried out with uniform samples.) The engineers said that anti-corrosion additives might be used either dissolved in the oil or in the form of insoluble powders or liquids, and that the more expensive oil-soluble compounds were not necessarily more effective.

★ ★ ★

Desalting Water From The Seas

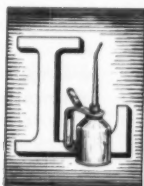
A University of California scientist, Dr. Leroy A. Bromley, has devised a new method for distilling sea water on a large scale. Although his equipment is still on the drawing board, it is estimated that it will be able to produce 100,000 to 200,000 gallons of demineralized water every day. In essence, the unit is a "multiple effect centrifugal evaporator." It consists of a series of trays mounted in tiers on a turbine. Water will be distributed from above, along the trays, and steam will be put into the unit in a segment below the trays. The heat then penetrates through the tiers, causing the water on each to vaporize, being condensed as fresh water on the bottom of the tray next above it. This runs off into a trap. The salt remains on the bottom of each tray and is removed by another trap. The steam would make the turbine rotate, spreading both the sea water and the fresh water in thin layers on their respective sides of the trays, thus allowing the use of many trays. Each unit will have half a dozen stacks of twelve to fifty trays and will be 10 feet in diameter and 12 feet high. Dr. Bromley estimates that the cost of producing salt-free water by this method would lie somewhere between \$.25 and \$.50 for every 1000 gallons.



STAINLESS SUPPORTS TUNNEL

An unseen, but important feature of the new twin-tube expressway that is being laid beneath the harbor at Baltimore, Md., is the use of stainless steel bars to suspend the base or floor of its huge ventilating duct. Fresh air enters the tubes below the roadways, and dangerous gases are eliminated by exhaust ducts that serve as the tunnel ceilings. Type 302 stainless steel was used because the supports could be comparatively thin, thus cutting down air flow resistance, while at the same time, would be sturdy enough to hold up the heavy ceilings or duct floors. In addition, Type 302 resists corrosion from moisture and exhaust gases—an important consideration where replacement of parts is difficult.

Oiling The Wheels



lubrication has developed into a practical science in only the last 2 decades. Its theory has made great strides as well, and its importance to industry can hardly be underestimated. According to users and manufacturers of modern precision machines, proper lubrication is the most important single factor in extending the service life of their equipment and assuring its peak performance. The two elements of proper lubrication are selection of the most effective lube, and its correct application.

FIFTY years ago, most lubricating oils and greases were applied by hand. Comparatively low equipment speeds, light bearing loads and large clearances made this method practicable, though it was recognized even then as being grossly inefficient. Today, with increased labor rates, such a practice would be inordinately expensive even if it were possible to do an adequate lubrication job. High speeds, heavy loads, the use of ball, needle, roller and spherical antifriction bearings and extremely close tolerances have made it absolutely necessary that lubricants be applied in some fashion that is not dependent on variations of human judgment.

Early in the machine age, even the largest equipment had relatively few moving parts and thus few points requiring oil or grease. Many modern machines have more than 50 bearing surfaces that require lubrication, and it is not uncommon for some complex equipment to have more than 200. It is asking the impossible to expect hand methods to apply the proper amount of lube to all of these points at the time it is needed most. If there are degrees of impossibility, then it is more impractical to ask that the job be done safely and without causing downtime.

Modern lubrication systems are mechanical and have all of the advantages of mechanization: they never tire; they can be designed to operate continuously, at timed intervals, or at intervals governed by the operation of the equipment they protect; and they can deliver measured quantities of lubricant with a precision born only of mechanical methods.

COMPRESSED air has the distinction of being utilized in the first automatic lube systems ever evolved. Today, air-operated lubrication is playing a rapidly growing role in automatic centralized methods, and although it cannot be said to be a panacea for all lubrication problems, it has many advantages over more conventional methods.

When compressed air power was seen to be the key to improved rock drilling methods, its flow through many of the earliest machines was utilized to carry lube oil to all working

parts. Since that time, all rock drills have been lubricated in that fashion, as well as pneumatic motors of all types.

THERE are two general types of air-powered lubricating systems. The first is the spray type that operates in much the same manner as do paint guns. The lubricant and the oil are brought to the spray head in separate tubes, the oil is broken up into small drops by the air, either in the nozzle or just outside at the tip, depending on the type, and then is delivered to the surface at which the head is aimed. As with any spray-type mechanism, the pattern covered can be varied by altering the shape of nozzle. Spray-type systems are most often used for lubricating open gearing and sliding surfaces. The method has many advantages over more conventional swabbing, dipping, dripping, brushing or pouring, chief among them being the reduced consumption of lubricant, thereby ending throw-off and drippage.

The other type may be defined as one in which the lubricant is actually air-borne in atomized form. The oil, drawn from a reservoir, is atomized in a venturi tube, and the air then carries it to the bearings. Atomized oil systems can also be broken down into two groups depending on whether or not the lubricant-carrying function of the oil is a primary one, or is secondary to the use of the air for power. The latter type is the one used in connection with rock drills, pneumatic tools and air motors and cylinders. Those systems in which air is used primarily for carrying the lubricant are often characterized by much lower pressures. Their development is generally credited to the need for continuous controlled lubrication of high-speed antifriction bearings. Utilization of this method has not only the advantages listed for automatic systems, but in addition, because of the internal air pressure of the bearings, there is always an outflow from them rather than an inflow that might carry abrasives or other contaminants onto the highly polished surfaces. Atomizing the oil also prevents any abrasive particles from accompanying the oil into the bearing. Until 8 to 10 years ago, atomized oil lubrication was thought to be practical for only small-size bearings, but today, lubrication engineers are applying it to the largest ones, as well.

AIR POWER thus has found another useful application in industry—one that not only results in better service from equipment, but better protection for capital investments. The outlook for its continued use is excellent, because no matter how good a lubricant is, it can be of no real use until the proper amount of it is applied to the right place at the correct intervals.

SAVING WITH AIR POWER

AIR REPLACES MUD

USE of compressed air as a means of reducing operating costs and at the same time increasing the penetration rate on high-speed oil drilling rigs was demonstrated recently on a wildcat venture in Atoka County, Okla. The technique, utilizing compressed air rather than mud as the circulating agent, resulted in the pushing of a 13,000-foot discovery well to a depth of 7000 feet in the first 20 days of drilling. Four compressors were used on the job, de-

livering air at a rate of 820 cfm at 300-psig pressure. Air from the units first entered a common manifold from which it was conducted to the rig through a 4-inch pipeline laid over the surface of the ground. It was passed into the rig's circulation system in the same manner as drilling mud, entering through its Kelley connection and passing down the drill stem to the point of drilling. There it emerged around the bit and returned up the outer casing wall to the surface, dis-

sipating frictional heat and carrying drill cuttings to an exhaust outlet some distance from the rig. The single-supply-line system greatly simplified the job of joining the compressors in parallel operation as need for greater air volume increased. Each air plant was trailer-mounted and equipped with special heat exchangers and moisture separators. As a safety precaution against explosive gases, spark-free diesel engines were used wherever possible.

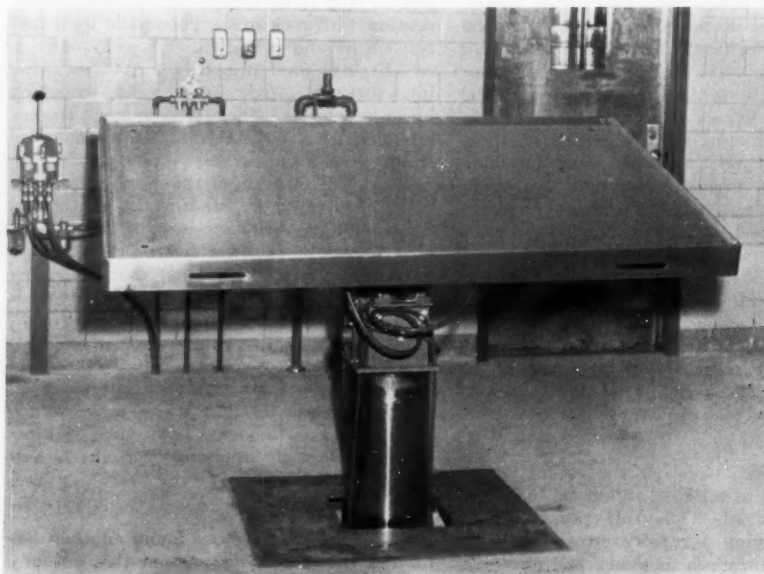
VETERINARY SURGICAL TABLE

COMPRESSED-AIR power has been applied to the problem of helping veterinary surgeons operate on large animals. Most operating tables, prior to the development of the one illustrated here, had but one motion: elevating (used primarily for autopsy work); or single-axis tilting (used for operating, generally). Such a table often made it necessary for a surgeon to stand on a stool or to operate in a cramped or awkward position. The New York State Veterinary College at Cornell University requested A. F. Gagne, Jr., Associates to design a table that could be raised

and lowered as well as tilted in either plane and also be free to rotate around a central support.

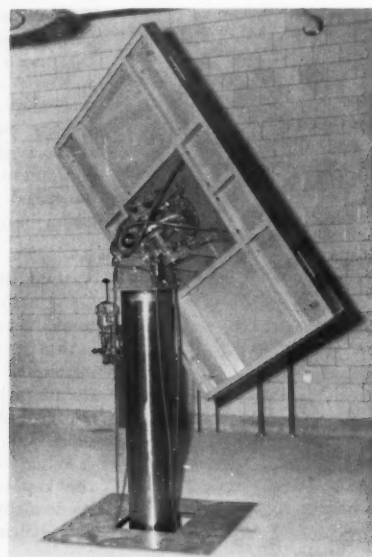
The table thus designed has a 4x6-foot stainless steel top and by means of a garage-type air-hydraulic lift, can descend to a point 16 inches from the floor or be raised to any practicable height. Tilting in either plane is accomplished by self-locking, worm-gear halves located in perpendicular planes and bolted to an intermediate plate. Large-size worm gearing was needed to carry the loads, and because of the height-above-floor-level requirement of 16

inches, the drive equipment for the worms had to be fitted into as small a space as possible to permit it to enter the hole in the floor left by the lift column. To accomplish this, Ingersoll-Rand vane-type air motors were selected to drive the worms. These motors deliver 0.65 hp each at a speed of 300 rpm, at a pressure of 100 psig, yet are less than 2 inches in diameter and 7 inches in length. The air motors are preferred for this service because they are compact, convenient to operate and are safe in hazardous or gaseous locations, being nonsparking. Furthermore, according to the designers of the table, the motors are trouble-free and cannot be damaged by overload. They also have the advantage of variable speed control by regulating the incoming air pressure. A Westinghouse Flexair control valve is used and combines all tilt control functions in but one valve.



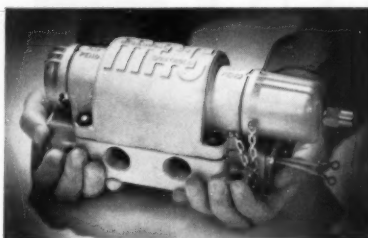
SURGICAL TILT TABLE

A general view of the table is shown above along with the air controls. The raise-lower valve is visible at the center and right rear, and the tilt-control Flexair valve, at the left rear. The other view shows the working parts of the tilt mechanism. The hoses running along the underpart of the table lead to tilt-limit valves that automatically cut off the flow of air to the pneumatic motors when the table has moved to its extreme position, thereby preventing damage to the mechanism.



Industrial Notes

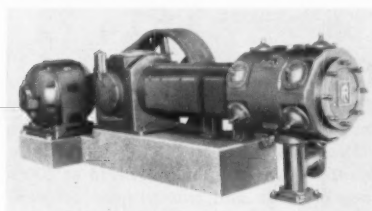
NONLUBRICATED compressors built by Ingersoll-Rand Company are for heavy-duty applications where the gas being compressed must not touch oil or other lubricants. The ESH-NL compressors, as they are designated, have special compressor cylinders that need no oil or lubricants due to the presence of self-lubricating materials in pistons and packing. The units also have I-R's nonlubricated Channel Valves. The ESH-NL uses the same frame and running gear as Ingersoll-Rand's ESH horizontal compressor, and is also available as a vertical unit, called ESV. A publication (Form 3251) discussing them, points out that the com-



115 v, 60 cycles. The manufacturer states that the valve may be converted quickly from a single-solenoid to a

double-solenoid type by first removing the retainer head and then inserting a covered assembly. In addition, the bases may be changed to convert valves to a different size. *Mechanical Air Controls, Inc., 10030 Capital, Oak Park, Detroit 36, Mich.*

FOREMEN, supervisors and straw bosses in general construction work as well as the amateur builder will be interested in an inexpensive pocket instrument that assures a level line of



pany pioneered nonlubricated compressor construction, and today builds NL machines in sizes from $\frac{1}{2}$ to 2000 hp. *Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y.*

INQUIRIES at industrial exhibits no longer need be filled out by hand. A plastic plate has been developed that makes use of the "credit card" idea used for many years for gasoline and department store charge accounts. Each plate bears the visitor's name, title, company and address, and booths at exhibits can be equipped with machines to record the information for later reference. It is said the card will do away with the problem of illegible handwriting on show inquiries that accounts for a large loss of sales leads. The card was used last April at the Design Engineering Show in Chicago, Ill. *Clapp & Poliak, Inc., 341 Madison Avenue, New York 17, N. Y.*

DUAL-SPOOL, an air valve available in $\frac{1}{2}$ - to $1\frac{1}{4}$ -inch port sizes, takes its name from its double spool arrangement. A solenoid activates an inner spool, which in turn releases compressed air to energize the larger, outer spool. It is said that the circular-flow design of the valve minimizes right-angle turns and provides full air flow throughout rated capacities. Reportedly, there is no lag between operation of either spool. Current requirements are 0.8 amperes in-rush and 0.125 amperes holding at

NEW SILENCER for air exhausts



High noise levels are effectively reduced by a new silencer developed by Air-Maze Corporation. Fits directly to exhaust ports or piping. Breaks up shock waves to attenuate objectionable noise without noticeably impairing efficiency

of air operated equipment.

Standard sizes for $\frac{1}{8}$ " - $\frac{1}{4}$ " - $\frac{3}{8}$ " - $\frac{1}{2}$ " - $\frac{3}{4}$ " pipe sizes.

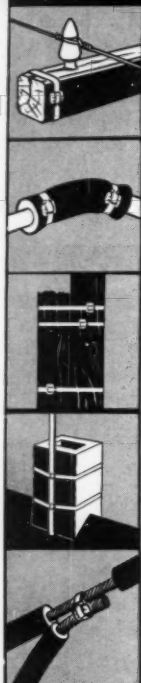
Write for details in Bulletin KK-657, **THE AIR-MAZE CORPORATION**, Cleveland 28, Ohio. Department CA-5.

AIR-MAZE

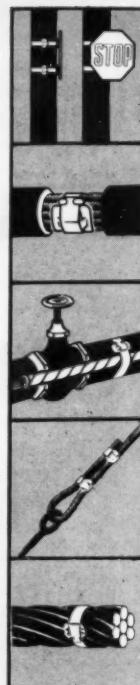
The Filter Engineers

AIR FILTERS • SILENCERS • SPARK ARRESTERS • LIQUID FILTERS
OIL SEPARATORS • GREASE FILTERS

with **BAND-IT** **CLAMPS** you can




BAND IT
FASTEN IT
CLAMP IT
CONNECT IT
BRACE IT
CLASP IT
SECURE IT
ANCHOR IT
TIE IT
CINCH IT




EASIER • QUICKER • LONGER • STRONGER

Clamps of all diameters formed without waste using only the


BAND-IT 'TRIO'



**BAND-IT
TOOL**



**BAND-IT
BUCKLES**



**BAND-IT
Stainless Steel
BAND
in 100 ft. rolls**

(BAND-IT JR. Preformed clamps
in 18 sizes also available)

BAND-IT band and buckles available in four widths ($\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", $\frac{1}{4}$ ") and in four metals—type 201 stainless steel, type 316 stainless steel, hi-carbon coated steel and silicon bronze.

BAND-IT clamps conform to any shape—any size.

Factory shipments of all four metals made to distributors in any quantity within 24 hours of receipt of order.

**SEND FOR NEW, FREE
16 PAGE CATALOG**

Over 1500 authorized **BAND-IT DISTRIBUTORS** throughout the United States and in 59 other countries of the world.

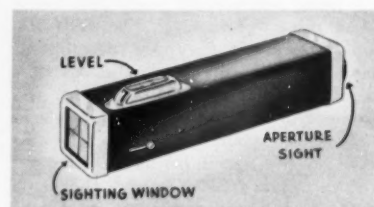
BAND-IT CO.

Incorporated 1937

4765 DAHLIA STREET • DENVER 16, COLORADO U.S.A.



sight for laying out building lines in the construction of driveways, fence lines, lawn grades, drainage lines and similar installations. It is used like a telescope once its bubble, recticle and the object being sighted are coincident. Differ-



ences in elevation between two points may be easily measured, and the accuracy of results is said to be within $\frac{1}{3}$ of 1 degree. *Edmund Scientific Company, Barrington, N. J.*

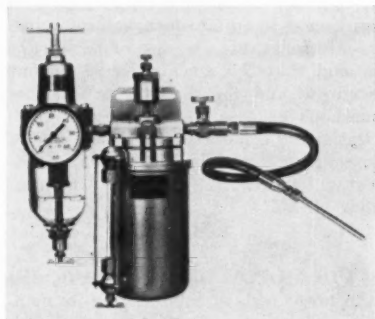
CONTROL of the piston speed of hydraulic cylinders is one of the primary purposes for a hydraulic control valve called the Flo-Set 1000. The mechanism is rated for hydraulic operation at 1000-psig pressure and can be used for controlling the speeds of other hydraulically operated devices. When used with cylinders, the valve allows the in-stroke and out-stroke speeds to be regulated separately, the result of having a free flow through the valve in one direction and a controlled flow through the valve in the opposite direction. It is said that



flow can be controlled from zero to the desired capacity with only one revolution of a calibrated adjustment sleeve. A set screw and locking collar are provided for locking the setting. Because the sleeve is graduated, flow patterns can be easily reestablished by referring to the previous setting. *Hanna Engineering Works, 1765 Elston Avenue, Chicago 22, Ill.*

FOUR Norgren Spray-Lube units that provide low-cost, compact installations for spray applications of liquids used to

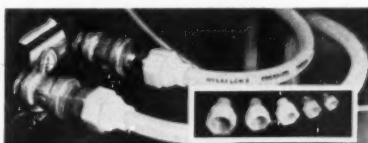
lubricate and cool either one or two cutting tools at a time, reportedly are responsible, in part, for increased tool service life and a reduction of lubricant costs. A filter-regulator removes damaging liquids and solids from the air stream and accurately controls pressure in the air-and-liquid lines. Reservoirs are available with either 1- to 2-quart capacities, and each has an adjusting screw and visible oil flow to permit precise flow control. A liquid-level gauge shows how much fluid is in the reservoir at all times, and a needle valve at the outlet of the reservoir serves as an on-off control. Semirigid hose, 15 inches long, is furnished. It can be bent and set to any position to direct the conical



spray for the best lubrication job. In the case of dual-point applications, a

wye and two hose lengths are furnished. C. A. Norgren Company, 3407 S. Elati, Englewood, Colo.

NYLON nuts, that can be temperature-cycled to 300°F without leaking,



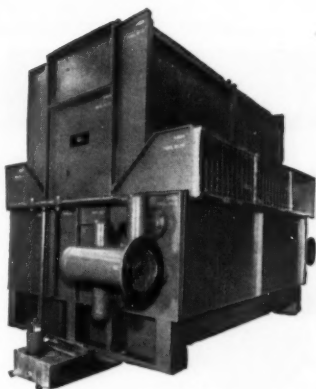
are said to resist loosening by vibration. Called Polypence, they are especially designed for sealing nylon pressure tubing to a metallic flare body and will not shear the tubing when overtightened. They are standard S.A.E. units with 45-degree flare, recommended for use in systems with maximum pressure of 250 psig. Under tension, the resilient nuts yield to provide a firm grip to compensate for flow tendencies of the tubing during temperature cycling. The Polymer Corporation of Pennsylvania, 2140 Fairmont Avenue, Reading, Pa.

LAND AREAS represented on maps, aerial photographs and drawings can be determined by an electric area calculator. A transparent grid is placed upon

ECONOMICAL COOLING OF GASES AND COMPRESSED AIR

Cooling gases or cooling and removing moisture from compressed air, the Niagara Aero After Cooler offers the most economical and trustworthy method. Cooling by evaporation in a closed system, it brings the gas or compressed air to a point below the ambient temperature, effectively preventing further condensation of moisture in the air lines. It is a self-contained system, independent of any large cooling of water supply, solving the problems of water supply and disposal.

Cooling-water savings and power-cost savings in operation return your



equipment costs in less than two years. New sectional design reduces the first cost, saves you much money in freight, installation labor and upkeep. Niagara Aero After Cooler systems have proven most successful in large plant power and process installations and in air and gas liquefaction applications.

Write for Descriptive Bulletin 130.

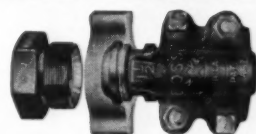
NIAGARA BLOWER COMPANY

Dept. CA-5, 405 Lexington Ave., New York 17, N. Y.

Niagara District Engineers in Principal Cities of U. S. and Canada



"GJ-BOSS" GROUND JOINT, STYLE X-34 HOSE COUPLING



The female-type coupling you can rely on for tight, safe connections on the big drills; manifolds; jumbos; in caisson work; and all other high-pressure operations. Copper insert in spud fits rounded head of stem, forming soft-to-hard, leakproof metal seal. "Boss" Offset Interlocking Clamp provides powerful grip on the hose—proof against blow-offs. Also available in washer type, and with companion male coupling. Sizes 1/4" to 6".



"BOSS" HOSE MENDER STYLE BM-16

The practical, safe way to quickly restore damaged hose to service. Complete fitting consists of mender tube and two "Boss" Interlocking Clamps. Tube has flanges to engage clamp fingers. Tube shanks have well-defined, smooth corrugations. Thoroughly rustproofed. Sizes 1/2" to 6".

Stocked by Manufacturers and Distributors of Industrial Rubber Products

DIXON
Valve & Coupling Co.

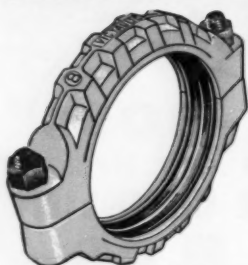
GENERAL OFFICES & FACTORY—PHILADELPHIA 22, PA.
BRANCHES—CHICAGO - BIRMINGHAM - LOS ANGELES - HOUSTON
DIXON VALVE & COUPLING CO., LTD. TORONTO Associate Companies
Buck Iron Company, Inc., Quakertown, Pa. - Precision Brass Steel Company, Camden, N. J.

VICTAULIC®



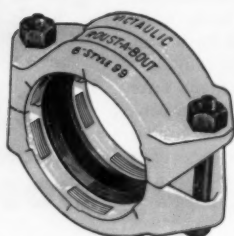
METHOD OF PIPING

VICTAULIC HAS EVERYTHING...



VICTAULIC COUPLINGS

Simple, fast, reliable. Styles 77, 77-D, for standard uses with steel or spiral pipe, — Style 75 for light duty. Other styles for cast iron, plastic and other pipes. Sizes $\frac{3}{4}$ " to 60".



ROUST-A-BOUT COUPLINGS

For plain or beveled end pipe Style 99. Simple, quick, and strong. Best engineered and most useful plain end coupling made — takes a real "bull-dog" grip on the pipe. Sizes 2" to 12".



VICTAULIC SNAP-JOINTS

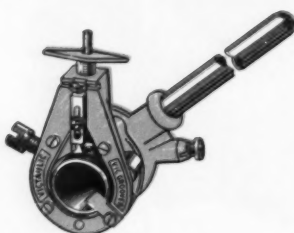
The new, boltless, speed coupling, Style 78. Hinged into one assembly for fast piping hook-up or disassembly. Hand locks for savings in time and money. Ideal for portable lines. Sizes 1" to 8".

COUPLINGS FOR EVERY PIPING JOB



VICTAULIC FULL-FLOW FITTINGS

Elbows, Tees, Reducers, Laterals, a complete line—fit all Victaulic Couplings. Easily installed — top efficiency. Sizes $\frac{3}{4}$ " to 12".



VIC-GROOVER TOOLS

Time saving, on-the-job grooving tools. Light weight, easy to handle — operate manually or from any power drive. Sizes $\frac{3}{4}$ " to 8".

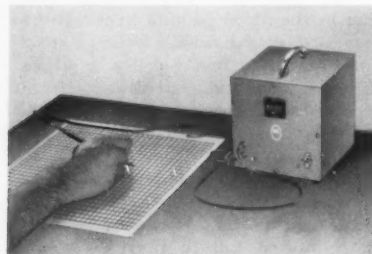
PLUS FITTINGS AND GROOVING TOOLS

"EASIEST WAY TO MAKE ENDS MEET"

Promptly available from distributor stocks coast to coast.
Write for NEW Victaulic Catalog-Manual No. B-5

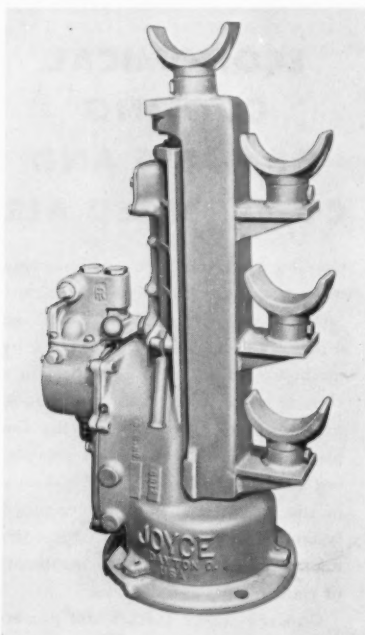
VICTAULIC COMPANY OF AMERICA
P. O. BOX 509 • Elizabeth, N. J.

the area to be measured. Then an electric stylus is drawn parallel to the grid lines within the area in question. This activates a high-speed counter within a panel. The counter records each 0.01 square inch in the area, and the total is



converted to square feet, square acres, square miles, etc., by use of tables. It is said that the machine is 99-percent accurate and much faster than other methods of area measurement. Calibrations of other than 0.01 inch can be supplied. *Martin-Kuykendall Company, 1002 4th Street, NW, Albuquerque, N. M.*

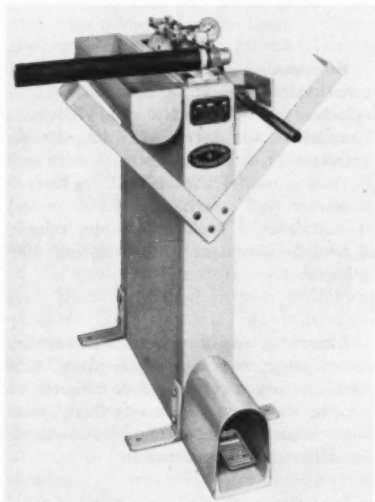
AIR MOTOR jacks designed to raise and lower reels of cable during its manufacturing are offered by the Joyce-Cridland Company. Four cast steel brackets are bolted to the top, front and



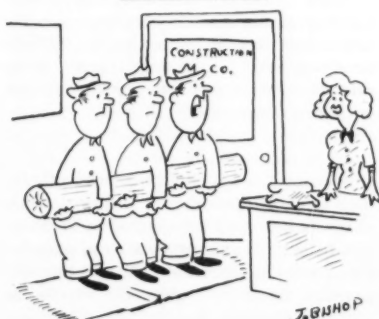
toe of the jack, described as a modified model 1720-R. After a shaft is inserted through the center of a cable reel, the shaft ends are supported between two of the air motor jacks at the desired bracket level. As insulation and coating are applied to the cable, the portion

receiving the application unwinds at constant level as the jacks raise and lower the revolving reel. One man can operate a pair of the units in synchronization by means of Y-valve controls. The jack operates on 90-psig air pressure, is 28 inches high, has an 18-inch rise, a 10-ton capacity and weighs 100 pounds. Jacks are available with trundling handle and roller-bearing wheels with semipneumatic tires if portability is desired. *The Joyce-Cridland Company, 2027 E. First Street, Dayton 3, Ohio.*

COUPLING of industrial hose is the job of Tension-Air Model TA-1 hose clamp that is said to join hose at a fast rate with uniform tension. The operation begins with the placing of the tube and the clamp in the machine and step-



ping on a pedal. The clamp is then locked securely with a single mallet blow, and the tail piece is broken off flush. The connection is said to be permanent, leakproof and reportedly will not snag. The machine is fitted with a clamp remover. Optional equipment for the unit consists of a hose rest, a hood and clamp holder and blow-down hose. *Punch-Lok Company, 321 North Justin Street, Chicago 7, Ill.*



"Just tell him the men from the wrecking company are here."

MAY 1958

12 NEW $\frac{3}{4}$ " and 1"

Norgren AIR LINE FILTERS

Make Norgren the most complete line available!

- For $\frac{1}{4}$ " through $1\frac{1}{2}$ " Pipe Sizes**
- Up to 300° F Operating Temperature**
- Removable Bowl**
- 5 to 250 psi Operating Pressure**
- Automatic or Manual Drain**
- Highly Efficient Water Removal**

REDUCE COSTLY WEAR ON YOUR AIR EQUIPMENT

...with Norgren Air Line Filters

- **Now, 98 Models to choose from**— $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ " and $1\frac{1}{2}$ ".
- **Abrasive Solids and Corrosive Liquids** are removed from air lines, reducing equipment wear, repair and replacement costs.
- **Transparent or Metal Bowls**
- **Choice of 4 Filter Elements**—74, 64 or 25 micron... 5 micron available in some sizes.
- **Automatic or Manual Drain**

For complete information about Norgren Air Line Filters, call your nearby Norgren Representative listed in your telephone directory—or **WRITE FOR No. 900 CATALOG**

If it's Norgren... It's Dependable.

C. A. NORGREN CO.

3407 SO. ELATI STREET • ENGLEWOOD, COLORADO

NOW!

KAHN offers the

NEW!**KAHN HEATLESS DESICCANT AIR DRYERS**

Reactivated without heat

Check these advantages:

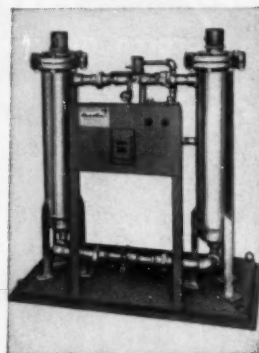
- * Costs reduced on installation and maintenance.
- * Steam and electric heaters eliminated . . . reducing utility costs.
- * Constant outlet gas temperatures.
- * Explosion proofing eliminated.

*It's***KAHN DRYERS***all the way . . .*

Kahn has a complete line of electric or steam regeneration dryers—automatic, semi-automatic or manual operative. Operating pressures up to 5,000 psi.

*Write for complete information.**Kahn and Company, Inc.*

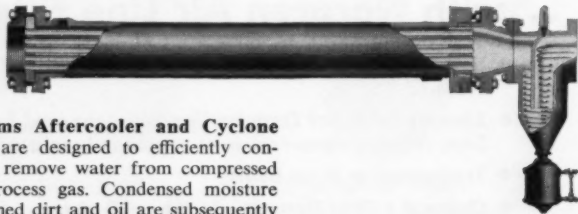
541 WINDSOR ST., Dept. B
HARTFORD 1, CONN.



Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.

209 East Park Drive, Buffalo 17, New York



The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm

where it is necessary to cool within 2° F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases the maximum pressure loss at rated capacities is ½ psi.

This wide range of sizes enables the economical utilization of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will solve your compressed air problems and save you money, write today for Bulletin 711.

BRIEFS

Gallium, a widely scattered but minutely deposited metal that melts at about 85°F, is being recovered from such ores as bauxite by Dow Chemical Company. Subdivided ore is treated with a current of hydrogen chloride or hydrogen bromide in substantially anhydrous conditions at temperatures of from 1292° to 1742°F. Although still undeveloped commercially, the metal has possible uses in electronics and as a replacement for mercury as an amalgamating agent.

It has been reported that an estimated 60 percent of last year's total available free world nickel supply was delivered to the United States.

For testing space vehicles and their reaction as they come back into atmosphere, the U. S. National Advisory Committee for Aeronautics has devised a heat and stress simulator. Although it uses a model that is but 1/3 inch in diameter and weighs but 0.005 pound, it simulates a 4000-mile-range missile, 3 feet in diameter and weighing 5000 pounds.

Uranium welding techniques have been investigated and researchers have noted that an argon-gas-shielded tungsten-arc process does the work satisfactorily, making a stronger, harder, though less ductile, bond than the parent metal.

The U. S. Navy has devised a box that is said to be atmosphere free. This was done by circulating dry argon gas through an inner chamber where non-volatile chemicals are used in researching modified inorganic chemicals. Reagents and equipment are inserted into the unit's antechamber where there is only trace leakage of water and oxygen.

Linde Company, a Division of Union Carbide & Carbon Corporation, recently announced that it guarantees a 99.995-percent purity for its argon gas. It is said to contain less than 50 parts per million of impurities.

Nicomo 1 is a nickel-promoted cobalt-molybdenum product in a low-density alumina base and is expected to increase catalytic hydrogen processing of petroleum from the current 800,000-barrels-per-day figure to 3,600,000 barrels in 1965. According to Davison Chemical Company, as much as 25-percent-less catalyst will be needed to fill a reactor.

Industrial Books and Literature

DUSTLESS drilling is possible with Ingersoll-Rand's RP38E VacuJet Dustless Stoper outlined in the company's bulletin, Form 4195. The booklet describes how the stoper sucks all dust and cuttings through the drill steel and the drill by vacuum, then pushes the cuttings to a container by positive pressure. An ejector jet in the backhead of the drill provides the vacuum for pulling in the dust. The vacuum is converted to positive pressure when it leaves the drill, and the cuttings travel through an ordinary 1-inch air hose to a bag or tank that can be 25 or more feet away. The bulletin states that the use of the stoper does away with awkward dust-hoods and expensive vacuum lines. Other cost savings are said to be achieved because the drill steels have a tapered bit end and shank. Reconditioning is accomplished by turning the bit end, and grinding or milling the shank end. Ingersoll-Rand Company, 11 Broadway, New York 4, N. Y.

FLOW Directory, the master catalogue of the material-handling industry, has just been published in the 1958-1959 edition. The volume is a guide to manufacturers and suppliers of material handling, packaging and shipping equipment. Six parts are included: an equipment and manufacturers section; a trade names index; a list of major manufacturers' catalogues and specification sheets; a geographic list of independent local outlets; a section concerning packaging and shipping equipment and supplies; and an engineering and technical data portion. Cost, \$7.50. The Industrial Publishing Corporation, 812 Huron Road, Cleveland 15, Ohio.

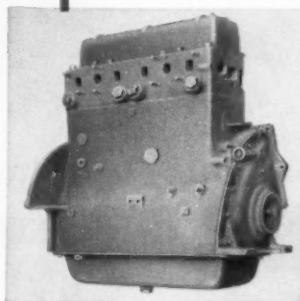
STANDARDS relating to iron castings have been compiled and published in a single volume. The 168-page book is designed for foundry men as a guide to the materials used by them. Listed are 32 standard and general methods of test relating to pig iron, gray iron castings, cast iron pipe, nodular and malleable iron castings, welding rods and electrodes. Cost, \$2.75. American Society for Testing Materials, Headquarters, 1916 Race Street, Philadelphia 3, Pa.

A TECHNICAL bulletin detailing the properties, advantages and uses of KT, a self-bonded silicon carbide, is available. The 4-page pamphlet contains tabulations of the properties, mechanical strength, thermal expansion coefficients, comparative thermal conduc-

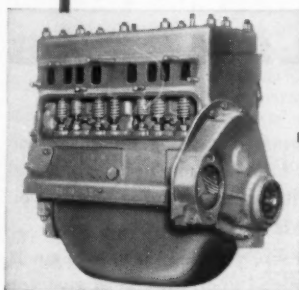
CONTINENTAL "S" Assemblies Save Money in the CONSTRUCTION INDUSTRY

Good news for every user of construction equipment with Continental power! All models in the Continental line of industrial engines are now available in "S" Assembly form—basic engine unit complete with cylinder-and-block assembly, oil pan, cylinder head, piston and valve assemblies, crankshaft, camshaft, gear cover, bearings and caps, crank and cam gears and front end plate, fully assembled and torqued to specifications.

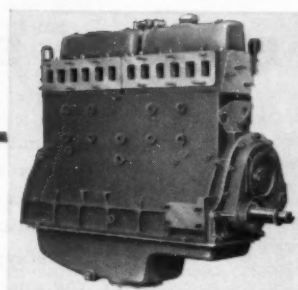
"S" Assemblies usually cost less than full overhaul, and they install in a fraction of overhaul time. And since the "S" Assembly embodies the latest results of Continental's continuing research, as regards both materials and design, it enables you to keep the very latest model on the job at all times.



DIESEL



L-HEAD



OVERHEAD VALVE

ASK YOUR EQUIPMENT DEALER ABOUT "S" ASSEMBLIES
OR WRITE THE FACTORY FOR INFORMATION



Continental Motors Corporation

MUSKEGON • MICHIGAN

6 EAST 45TH ST., NEW YORK 17, NEW YORK • 3817 S. SANTA FE AVE., LOS ANGELES 58, CALIF.
8218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 1252 OAKLEIGH DR., EAST POINT (ATLANTA) GA.

tivity, oxidation resistance in air, resistance to corrosive liquids and stability in steam of the material. It also indicates electrical properties, fabricability and such possible uses as ball mill liners, heat exchanger parts, valve components for corrosive liquids and nuclear reactor parts. *The Carborundum Company*, Advertising Division, P.O. Box 337, Niagara Falls, N. Y.

RLM STANDARD Specifications Book (1958 edition) is a reference guide designed for all persons concerned with the purchasing, specifying or selling of industrial lighting units. Included are de-

scriptions of 2- and 3-lamp special-service fluorescent units, 3 varieties of fixtures utilizing 800 milliampere fluorescent lamps, incandescent reflector sizes and mounting details for fluorescent lights. Each individual specification is contained on the front and back side of a single page so that each may be easily detached to be placed with equipment quotations. The book is available without cost. *RLM Standard Institute*, 326 W. Madison Street, Chicago 6, Ill.

LINCOLN lubricant application equipment has been described in a brochure (No. 92) that is amply illustrated with

dimensional drawings. Such items as lubrication fittings, grease guns, centralized power lubrication systems and accessories are featured. *Lincoln Engineering Company*, 5703-32 Natural Bridge Avenue, St. Louis 20, Mo.

TWO safety publications are available for industry—one for employees and the other for foremen. The former, *Rules For Safety*, contains 40 pages of do's and don'ts and how's and why's of accident prevention in the use of power tools, in stacking material and lifting and carrying. The other has 52 five-minute talks that provide full and balanced coverage of all the major types of occupational accidents. It is called *Book 8* and has a range from "Why We Have A Safety Program" to "Bumping Into People and Things." *National Safety Council*, 425 N. Michigan Avenue, Chicago 11, Ill.

FIRE PROTECTION in the plant is the subject of *Fire Protection Service Plan*. The brochure explains how a company can protect itself against fire loss. It emphasizes the need for fire-fighting training and fire-protection planning. Other services available to users of Ansul equipment, such as in-plant fire protection surveys, visual aids for training meetings, fire-control training and demonstrations and fire schools for supervisory personnel, are explained. *Ansul Chemical Company*, Director Technical Services Division, Marinette, Wis.

APPARATUS manufactured by Niagara Blower Company is described in an 8-page bulletin (No. 135) published by the firm. Descriptions are given of after-coolers, air conditioners, liquid coolers, heat exchangers, condensers and refrigeration equipment. These units are designed primarily for chemical, food, metallurgical and plastics applications.

Niagara Blower Company, 405 Lexington Avenue, New York 17, N. Y.



now!

IMMEDIATE DELIVERY

ON MANY TYPES AND SIZES OF

MAXIM SILENCERS

Need silencers on short notice? Contact Maxim. We are now stocking an increasing number of the more widely used types and sizes. As a result, we may be able to give you immediate delivery.

If the type and size you need is not in stock, you can still depend upon Maxim to give you best delivery—from the *most complete line of industrial silencers*. Equally important, you can count upon outstanding performance—in the tradition that has made Maxim the preferred silencer throughout industry. Maxim, more than ever, stands for special customer service.

THE MAXIM SILENCER COMPANY

Subsidiary of Emhart Manufacturing Company

61 HOMESTEAD AVENUE • HARTFORD, CONN.



"See what I mean?"

COMPRESSED AIR MAGAZINE

**It is
EASIER
TO
INSTALL**

**It takes
LESS
SPACE**

**Its
ACTION
IS
FASTER**

**It is
EASIER
TO
CONTROL**



FOUR GOOD REASONS WHY YOU SHOULD BUY THE BELLOWS AIR MOTOR ...THE AIR CYLINDER WITH THE BUILT-IN ELECTRIC VALVE

When it comes to downright value, it's hard to visualize an air cylinder that can even approach the Bellows Air Motor. For here is a complete packaged air cylinder power unit with all controls built-in: 8-12 volt, electrically-actuated directional valve*, two independent speed controls, and an air transfer system that makes it possible to bring air to the unit through a single flexible hose. No extra valves to buy, no cumbersome piping to install.

1016-B

For detailed data — do this:

Write Dept. CA-558, The Bellows Co., Akron 9, Ohio (in Canada, Bellows Pneumatic Devices of Canada, Ltd., Toronto, 18) for Bulletin BM-25. Or, if you prefer, phone your Bellows Field Engineer—he's listed in the phone book under "The Bellows Co."

The feature of the integral valve brings important advantages. Installation is easier, electrical hook-up is simpler. It fits well in cramped quarters, or on moving machine elements. And of even more importance—the built-in valve means faster action, quicker response, less air consumption, and positive control over piston rod movement.

The Bellows Air Motor is made in five bore sizes: 1¼", 1¾", 2½", 3⅝" and 4½" and in any stroke length. You can have your choice of six different built-in valving arrangements, plus optional hydraulic piston movement stroke control.

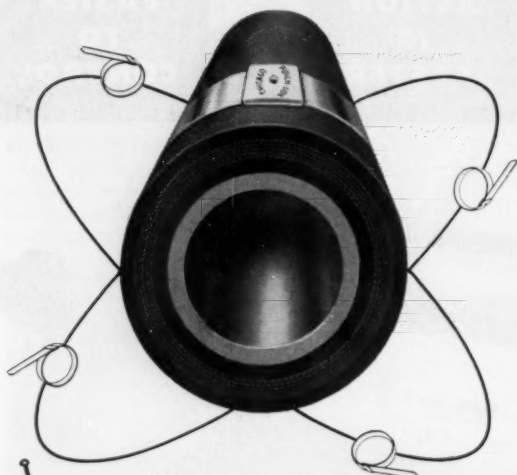
*115 Volt for J.I.C. applications, if desired.

The Bellows Co.

DIVISION INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

IN ORBIT for a LIFETIME!



PUNCH-LOK Hose Clamps

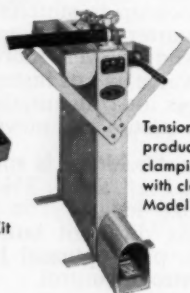
MR. LOK SAYS:
When a Punch-Lok clamp goes into orbit around a hose connection it's there to stay.

DOC PUNCH SAYS:
Tell the hose user it's a life-saver prescription for outer-space too.
NO SNAG! NO LEAKS!

NEW! from PUNCH-LOK



New K-45 Clamp-Master Kit now in all-steel carrying case finished in red baked-on enamel.



Tension-Air production hose clamping machine with clamp remover Model TA-1.

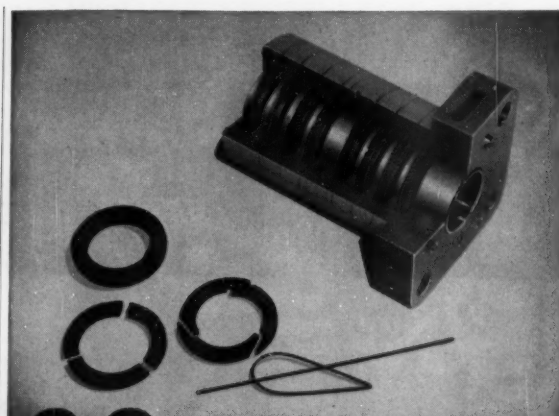
See your nearby Punch-Lok Distributor

8382


"The Sign of
a GOOD Hose Clamp"

PUNCH-LOK
Company

Dept. H, 321 N. Justine Street, Chicago 7, Illinois



Look to **COOK** for Better CARBON PACKING RINGS!

Cook carbon packing rings are made of a special carbon graphite material that automatically assures you *high resistance to wear, chemical inertness and excellent heat conductivity.*

If you have sealing requirements for non-lubricated compressors, write today for a sample carbon ring, plus

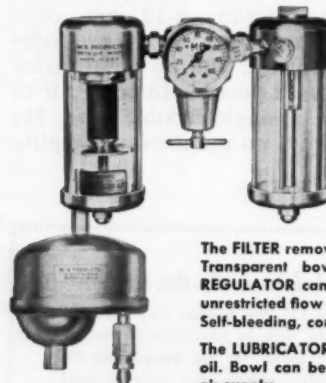
literature on Cook's complete line of packing materials. Address C. Lee Cook Company, 930 South Eighth Street, Louisville 3, Ky.

**C. LEE
COOK**
COMPANY
Sealing Pressures Since 1888

GREATER PROTECTION
to your **AIR LINE!**

M-B

**WHIRL-A-WAY FILTER, REGULATOR
AND LUBRICATOR ASSEMBLY AND
AUTOMATIC AIR TRAP (MODEL W-4)**



**SUCCESSFULLY
USED FOR
PROTECTION
OF AIR VALVES
CYLINDERS
CONTROLS
PNEUMATIC
TOOLS, ETC.**

The **FILTER** removes solids .00039 and larger. Transparent bowl provides visibility. The **REGULATOR** can pass large volume with an unrestricted flow and minimum pressure drop. Self-bleeding, compact.

The **LUBRICATOR** delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

The Air Trap is automatic and eliminates manual draining.

M-B PRODUCTS
46 VICTOR AVE., Div. 14
DETROIT 3, MICHIGAN

GYRO-FLO *in the news*



▲ High holes, horizontal or at any angle, are no problem at all with this truck-mounted drilling rig. Operator at the control station can "spot" the drill anywhere he wants at the touch of a throttle.

▼ Photo below shows that toe holes are "duck soup" for this Gyro-Flo 900 and Hydra-Boom combination.



Truck-Mounted Drilling Rig Helps Contract Driller Meet Deadline Dates

"Take a highway truck chassis, add a 900-cfm Gyro-Flo compressor and two I-R Hydra-Boom units equipped with two D45, 4½" Bore drifter drills, and you're in business with the fastest contract-drilling unit you ever saw." So says an official of the New Jersey Drilling Co., who admits that this is a slight oversimplification. "Some planning and good design went into this rig, too. The I-R distributor and sales engineer sure did a fine job on this rig."

The truck-mounted drilling rig shown here has lived up to his every expectation—helped him finish up faster and meet the tightest deadlines with a minimum of man-hours and drilling expense.

GYRO-FLO 900 PROVIDES AMPLE AIR POWER

A standard 900-cfm Gyro-Flo rotary portable compressor, less running gear, was mounted on a 6-wheel highway truck chassis. There was plenty of room available to mount two Hydra-Boom drills. The completely self-contained compressor provides ample air power for any job—will run both heavy-duty drills simultaneously at full pressure. The rig can move from job to job at a moment's notice and at maximum highway speeds. A frame above the compressor holds the drill towers while in transit.

HYDRA-BOOMS CONVERT SETUP TIME TO DRILLING TIME

With two heavy-duty I-R D45 rock drills mounted on Hydra-Booms, the New Jersey Drilling Co. can set up to drill any type of hole patterns in a matter of minutes. All drill-tower motions, including power dump and swing and power cone, are controlled by the touch of a throttle. Husky hydraulic cylinders, five for each drill, have completely replaced the time-consuming muscle power formerly required to set up for each hole.

Ask your Ingersoll-Rand representative to show you how Gyro-Flo compressors and I-R rock drills can help speed your drilling work, with important savings in cost per foot of hole.

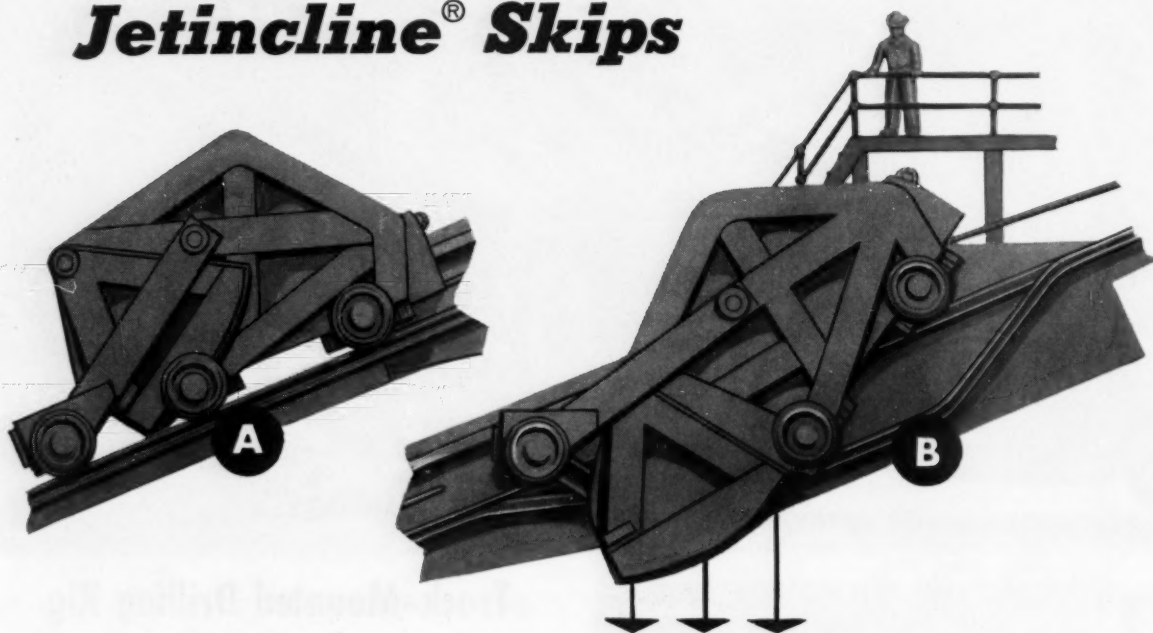


Ingersoll-Rand
2-835 11 Broadway, New York 4, N. Y.

AN UNBEATABLE COMBINATION . . . GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS

For economical open pit haulage . . .

LAKE SHORE Jetincline® Skips



The JETINCLINE Bottom Dump Skip has all the advantages of Lake Shore's famous "Jeto" skip—fast, clean dumping and lasting construction. Capacities are available up to forty-five tons.

Dumps clean every trip. As the skip approaches the dumping station, the narrower rear body rollers follow the lower rails of the scroll and the skip is actuated. As this occurs, the rear door opens and the ore flows out unrestricted. The stubborn, sticky ore in bottom corners is immediately cleaned by the following loose ore.

Dumps fast every trip. Because the skip body rotates a limited amount during dumping, it therefore transfers minimum stresses to the headframe and can be dumped faster and more smoothly than any other type of skip.

Rugged construction. High manganese wheels of the JETINCLINE skip are equipped with tapered roller bearings and the axles are spring mounted on three point suspension directly to the body of the skip. This arrangement allows the highest concentration of weight and strength to be placed where it is needed most, in the body. In the largest skips the body is reinforced with sections that run to sixteen inches in thickness. In addition, all skips are equipped with heavy cushioned liners inside.

For increased production, many mines have converted to Lake Shore "Jeto" and JETINCLINE bottom dump skips. Their faster dumping and lasting construction are your assurance of more production at lower cost. For full details see your Lake Shore representative or write our Engineering Division, Iron Mountain, Michigan.

LAKE SHORE, Inc.

Lake Shore Engineering Division

IRON MOUNTAIN 5, MICHIGAN

free
catalog



WRITE
BEFORE
NEXT
TUESDAY

47-page catalog illustrating
complete line of

ALLEN AIR
AIR CYLINDERS
AIR VALVES & CLAMPS
DIAL FEED TABLES

The cylinder of "distinction" shown above
is a Factory Reject. Only straight rods
available.

THE A. K. ALLEN CO., 255 East 2nd St., Mineola, N. Y. CA-5

Name _____

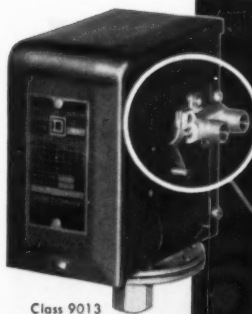
Company _____

Address _____

City _____

Zone _____

State _____



Class 9013
Type ASG
Form X

HEAVY DUTY
**PRESSURE
SWITCH**
FOR AIR
COMPRESSORS

COMPLETE RANGE IN
1 CONTROL UNIT

Either 20 to 180 or 25 to 250 PSI.
No spring changes required.

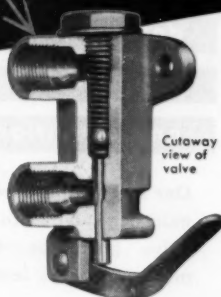
MORE AIR CAPACITY
with improved 2-way ball
and "O" ring type valve.

Write for Bulletin 9013A. Address Square D Company,
4041 N. Richards Street, Milwaukee 12, Wisconsin



NOW... EC&M PRODUCTS ARE A PART OF THE SQUARE D LINE

SQUARE D COMPANY



Cutaway
view of
valve

DEPENDABLE PNEUMATIC SERVICE



WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by sus-
pending it from the piping, with-
out any other support, or may
stand on the floor near equip-
ment being protected.

DRIAIR speeds produc-
tion by separating and
automatically ejecting
the condensed water and
oil from the air. DriAir collects dirt and rust from
the air lines and delivers clean dry air to the tools,
thus reducing wear and prolonging their life. All
internal parts are made of bronze or copper—
resistant to corrosion and practically permanent.
Copy of Bulletin DA fully describing the operation
of DriAir sent on request.

**NEW JERSEY
METER COMPANY**
PLAINFIELD, NEW JERSEY

New TOLEDO CAM-TYPE DIE HEAD

FASTER...EASIER...MORE ACCURATE



2 Sizes

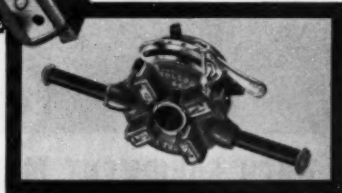
NO. 44 1/4" to 3/4" PIPE
1/4" to 1 1/8" BOLT

NO. 66 1" to 2" PIPE
1 1/4" to 2" BOLT

Accuracy Without
Resetting

Clamping Lever That
Won't Loosen

Instant Change From
One Size to Another



- Fully adjustable to cut oversize, undersize and standard threads.
- Floating scroll acts only to control thread size. Back plate and body bolted securely together—assuring maximum bearing surface for chasers.
- Elongated jaws in centering device grip pipe securely—prevent die head from dropping on completed thread when dies are moved to open position.
- Easy-to-read size gauge . . . even through oil film. Bolt threads in all sizes set to same mark.
- Dies can be instantly released from completed thread—no slow backing off.
- Optional pipe centering device insures accurate threading. Can be quickly removed if desired.

For faster, easier and more accurate threading, see the TOLEDO No. 44 or No. 66 at your supply house now.



Quality Checked

BUILDERS OF THE WORLD'S FINEST PIPE TOOLS

TOLEDO®

PIPE THREADERS • PIPE WRENCHES • PIPE MACHINES

THE TOLEDO PIPE THREADING MACHINE CO.
TOLEDO 4, OHIO

LOW COST

Preventive
Maintenance

For Pipe, Pipe Joints,
Fittings, Couplings,
Tanks, etc.



Use TAPECOAT®

...the Quality Coal Tar Coating in Handy Tape Form

To combat corrosion on underground pipe lines, you need the best possible protection at lowest possible cost. Since 1941, TAPECOAT has proved its superiority in resisting moisture, acids, alkalis, chemical fumes, electrolysis, soil stress, salt water and other severe corrosive and abrasive conditions. TAPECOAT is self-bonding, easy to apply spirally with the use of a torch. Requires no skilled help. Cuts maintenance and replacement costs. Comes in rolls of 2", 3", 4", 6", 18" and 24" widths.

Write for brochure and prices

The TAPECOAT Company

1571 Lyons Street
Evanston, Illinois

Sales and Service Offices in Principal Cities

24 HOUR SERVICE

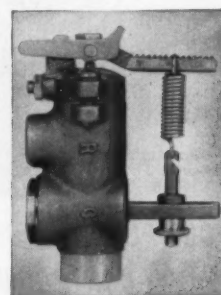
Factory Rebuilt

UNLOADER VALVES

any age

any make

any condition



One day is all it takes to change old, worn-out unloader valves into factory rebuilts with new valve guarantee. Conrader exchanges all makes. Cost 1/3 less than new valves.

HOW'S YOUR STOCK OF SPARE VALVES?

R. CONRADER CO. INC.

BOX 924 • ERIE, PA.

The SNAP Makes the Difference

IN THIS AIR TRAP



**NO COSTLY AIR LEAKS
WITH THE
ARMSTRONG
SNAP-ACTION TRAP**

The spring-powered valve snaps wide open for fast drainage, snaps tightly closed before all water leaves trap—always a perfect water seal. No dribbling, no air loss. Snap-closing prevents fine grit from holding the valve away from the seat.

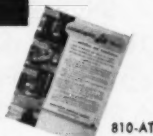
Trouble-free construction: the flat-strip spring of special Swedish steel lasts for years . . . valve and seat are hardened chrome steel. Cast semi-steel body for pressures to 250 lbs., forged steel for pressures to 1000 lbs.

SEND FOR HELPFUL BULLETIN

Bulletin 2024 tells how to select the right air trap for any job. Gives complete information on all Armstrong air traps for every service. To get your copy, just call your local Armstrong Representative, or write:

8853 Maple St., Three Rivers, Michigan

ARMSTRONG MACHINE WORKS



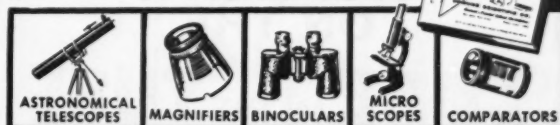
810-AT



FREE CATALOG!

FEATURING OVER 1000

OPTICAL BUYS



SATELLITE
SCOPES



PROJECTORS



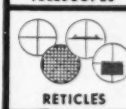
POCKET
MICROSCOPES



LENSES, PRISMS
WEDGES



INFRARED
TELESCOPES



RETICLES

OPTICS FOR INDUSTRY!

Optics for the space era . . . Satellite Scopes, Astronomical Telescopes, etc.

MANY ON-THE-JOB HELPS . . . QUALITY CONTROL AIDS!

Write for this amazing Catalog! You won't be sorry! 80 pages — hundreds of illustrations, charts, diagrams. A treasure-house of optical information . . . bargains galore. Optics for industry! Scopes for observing Satellites, Moon, Planets, Rockets. Optics for research labs, experimenters, hobbyists! Instruments for checking, measuring — to speed your work, improve your quality, cut your costs. We give you FACTS, no fluff. Tell you what it is — how it works — where it's used!

COMPARATORS, MAGNIFIERS, MICROSCOPES

Countless war surplus bargains — ingenious optical tools from foreign lands. Thousands of optical components: Infrared telescopes, microscopes, magnifiers, lenses, prisms, wedges, mirrors, mounts — accessories of all descriptions. We are reliable. You deal with us by mail. No salesman will call. Shop the Catalog of America's greatest optical mart. Mail coupon. No obligation.

MAIL COUPON FOR FREE CATALOG!

EDMUND SCIENTIFIC CO., Barrington, New Jersey
Please send me FREE OPTICAL CATALOG "EA"

Name
Company
Address
City Zone State

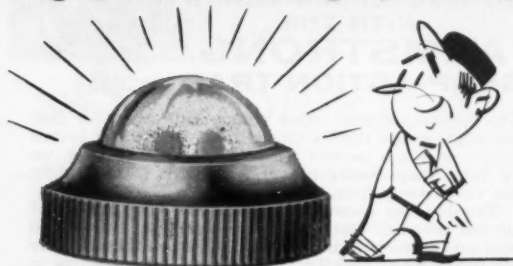
ADVERTISERS INDEX

Adams Co., Inc. R. P.	42	Eimco Corporation, The	7
Air-Maze Corporation	37	Gits Bros. Mfg. Co.	52
Allen Co., The A. K.	49	Ingersoll-Rand Co.	10, 11, 47, Back Cover
Anaconda Company, The	12, 13	Kahn and Company, Inc.	42
Armstrong Machine Works	51	Lake Shore, Inc.	48
Band-It Co.	38	Marathon Electric	5
Bellows Co., The	45	Maxim Silencer Company, The	44
Bethlehem Steel Company	3rd Cover	M-B Products	46
Bucyrus-Erie Company	8	Naylor Pipe Company	2nd Cover
Combustion Engineering	4	New Jersey Meter Company	49
Commercial Filters Corporation	6	Niagara Blower Company	39
Conrader Co., Inc. R.	50	Norgren Co., C. A.	41
Continental Motors Corporation	43	Punch-Lok Company	46
Cook Mfg. Co., C. Lee	46	Square D Company	49
Coppus Engineering Corporation	9	Tapecoat Company	50
Dollinger Corporation	1	Texas Company, The	2
Dixon Valve & Coupling Co.	39	Toledo Pipe Threading Machine Co., The	50
Edmund Scientific Co.	51	Victaulic Co. of America	40

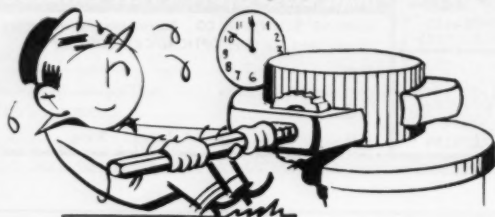
DON'T WASTE TIME ON THE LUBE IN THE TUBE



JUST GLANCE AT THE FOAM IN THE DOME

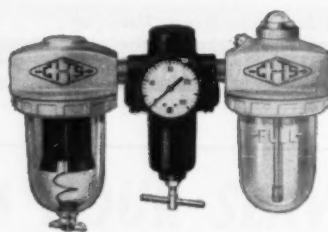


NO NEED TO STOOP OR SQUINT OR SQUAT,
TO FIND THE SMALL, DIM VIEWER SLOT...



TO CHECK THE DROPS, DON'T SET TOO FAST,
THE OIL SUPPLY WILL NEVER LAST...
NO TINKERING, NO WASTE OF TIME,
TO SET THE METER SUPER-FINE!

A SHORT GLANCE QUICKLY VERIFIES
THAT OIL IS ACTUALLY ATOMIZED...
GITS MIST-A-DOME IS LARGE AND CLEAR,
A SNAP TO CLEAN OF SMUDGE AND SMEAR.



FOR AIR LINE LUBRICATION, GET
THE DOPE ON GITS COMPLETE MATCHED SET.



THIS NEW FREE CATALOG TELLS MORE,
YOU'LL FIND ADVANTAGES* GALORE,
SO TELL US THAT YOU WANT DETAILS,
WE'LL DROP IT PRONTO IN THE MAIL.

GITS

BROS. MFG. CO.

Pneumatics Division

1852 South Kilbourn Avenue, Chicago 23, Illinois

*Reduced Inventory, Minimum Pressure Drop,
Increased Lubrication Flexibility and many more.



Where Huge New Stores of Power Will Be Created. One of the great construction jobs of our time is under way at the International Rapids section of the St. Lawrence Seaway project. The magnitude of the task is well illustrated by the view above, which shows work in progress on the Barnhart Island power plant. When completed, the giant installation will straddle the boundary between the United States and Canada, providing vast new stores of power for both nations.

Big gantry cranes have been tireless workers at many key points of the job. To handle the high, unwieldy lifts, they must be rigged with tremendously strong wire rope, and large quantities of Bethlehem Purple Strand have been furnished for the purpose. This tough steel cable, in both the 7/8-in. and 1 1/8-in. sizes, has always proved a willing worker, and more than a match for the heavy loads assigned it.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation.

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

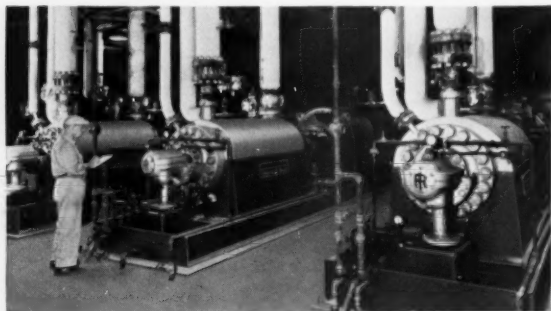
CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING



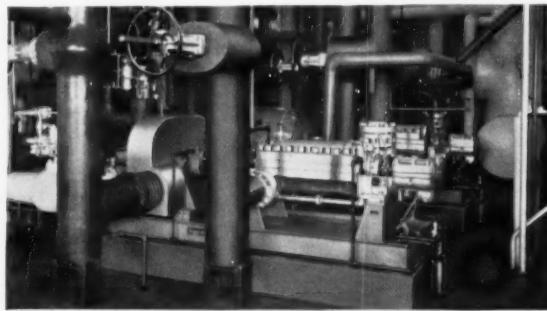
BOILER FEED PUMPS GIVE DEPENDABLE PERFORMANCE

at all pressures, capacities, temperatures.

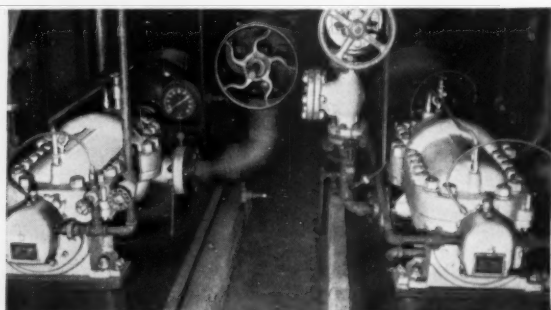
Typical I-R installations indicate wide range of use in central stations and industrial plants



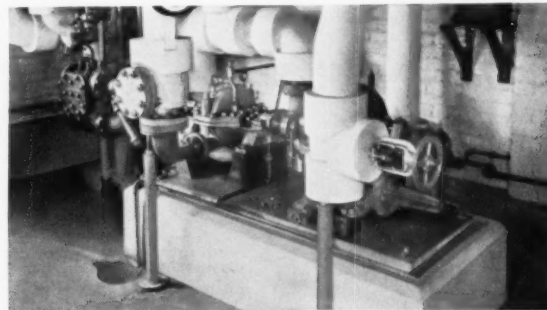
PRESSURES UP TO 6500 psi.—Class CHTA-CHTB: These multi-stage, cylindrical "double-case" pumps meet the most exacting needs of the highest-pressure boilers in modern central station service. Each of the above pumps handle 1100 gpm of feedwater at 2395 psi.



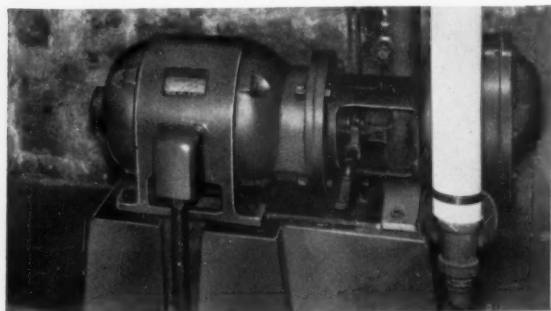
PRESSURES UP TO 1200 psi.—Class HMTA-HMTB: A complete line of multi-stage centrifugal pumps featuring a symmetrical, horizontally-split casing, and a simplified unit-type rotor assembly. The pumps illustrated are on boiler feed service in a large textile mill.



MEDIUM PRESSURES UP TO 1000 psi.—Class CNTA: Symmetrical design with unit-type rotor gives CNTA pumps higher efficiency, easier maintenance, and attractive modern appearance. Installed in a large paper mill, the boiler feed pumps shown operate at 3560 rpm and deliver 180 gpm at 605 psi.



PRESSURES TO 450 psi.—Class GT: Dependability is designed into this line of two-stage, horizontally split pumps. Standard construction includes renewable wearing rings and water-cooled, ring-oiled bearings. Pump shown serves as a boiler feed unit in a large candy factory.



PRESSURES TO 250 psi. — Motorpumps: A complete line of space-saving centrifugal pumps, including both close-coupled and cradle-mounted types. Single, two-stage, and vertical four-stage models are available. Pump shown is handling boiler feed in a leather factory.

Ingersoll-Rand boiler feed pumps have many refinements in design and construction that add up to high operating efficiency. Skilled manufacture and painstaking factory inspections assure dependability built into every pump. Inherent simplicity and ruggedness mean easier and less maintenance—and trouble-free performance.

Whatever pressure or capacity you need, Ingersoll-Rand can supply a boiler feed pump for the job. I-R engineers will gladly help you select the pump that meets your needs.

Ingersoll-Rand

10-380

11 BROADWAY, NEW YORK 4, N. Y.

COMPRESSORS • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • CONDENSERS • PUMPS • ROCK DRILLS • VACUUM EQUIPMENT